PRELIMINARY

D R A F T

SOLID WASTE MANAGEMENT PLAN

AND

DRAFT ENVIRONMENTAL IMPACT REPORT

for

ALAMEDA COUNTY
August, 1975

. Alameda County Planning Department

. Alameda County Solid Waste Management
Plan Advisory Committee

. Alameda County Solid Waste Management
Plan Technical Advisory Committee

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D R A F T

ALAMEDA COUNTY SOLID WASTE MANAGEMENT PLAN

Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

Maps

Figures

Table of Contents (Continued)

Tables (Continued)

Table of Contents (Continued)

Tables (Continued)

Table of Contents (Continued)

Tables (Continued)

Table of Contents (Continued)

Tables (Continued)

D R A F T

ALAMEDA COUNTY SOLID WASTE MANAGEMENT PLAN

Preface

On July 13, 1972, the Governor approved Senate Bill 5 adding Title 7.3, Section 66700 et. seq., to the Government Code, providing that each county prepare, subject to the approval of the plan by a majority of the cities within the county containing a majority of the population within the incorporated area of the county, a comprehensive, coordinated solid waste management plan for all waste disposal within the county to be disposed in or outside the county. The Legislature's declared intent is that primary responsibility for adequate solid waste management planning shall rest with local government.

In June, 1972, the Alameda County Board of Supervisors designated the Planning Commission as the appropriate agency to handle solid waste management planning in Alameda County. The Board, in December, 1972, began appointments of the 23-member Solid Waste Management Plan Advisory Committee, consisting of five representatives of the Mayors' Conferences; five from the operators, including the East Bay Municipal Utility District; ten from the public; and three from the Comprehensive Health Planning Council. A Technical Advisory Committee, consisting of staff members of representatives of Federal, State, regional, County, city, and special districts, and the industries, was formed. Both groups have met at least monthly since April, 1973.

The Alameda County Planning Director and Staff have been responsible for the preparation of the plan with guidance from both committees.

The State Solid Waste legislation requires review and public hearing by each of the thirteen cities in the County with resolution of approval of the County Plan or a statement of reasons for failure to approve the Plan. After completion of city public hearings, the County Planning Commission holds public hearings and makes recommendations to the Alameda County Board of Supervisors for public hearings. Submittal of the final draft plan and documentation of city approval by the County to the State Solid Waste Management Board is required by January 1, 1976.

Environmental Impact Report:

The Alameda County Solid Waste Management Plan and the Environmental Impact Report are both contained within this document. Although Section IX is titled Environmental Impact Report, the entire plan document provides reference material required by the California Environmental Quality Act.

The Environmental Impact Report was prepared by the Alameda County Planning Department in accordance with the requirements of the Environmental Quality Act of 1970 (CEQA), State Guidelines for the Implementation of the Act, and revised Alameda County Guidelines dated February 7, 1974.

I. SUMMARY

A. Background

Alameda County ranked fifteenth among 58 California Counties in estimated total annual solid waste production in 1967.[1] In that same year, it was fourth in the State in municipal waste (residential, commercial) generation, and third in industrial waste generation (when lumber industry wastes were excluded). Today, slightly over a million tons of waste per year is deposited in fewer than ten landfills. As a result of the changes in laws and attitudes, the County has been evaluating solid waste management practices in an effort to determine what changes must be made in the system and to develop a County-wide waste management plan. This Solid Waste Management Plan for Alameda County is the culmination of the work that has been carried on by two County-wide planning committees since January, 1973, the Technical Advisory Committee and the Board of Supervisors' appointed Solid Waste Management Plan Advisory Committee, working in conjunction with the Alameda County Planning staff.

There are slightly over a million people living in Alameda County today who rely upon the scavenger industry and government for waste collection and disposal. A majority of the population, and hence the waste, is collected in the urban western portion of the County in the thirty-mile-long coastal plain between Fremont and Berkeley. In addition, the County has one of the nation's largest scavenger companies (Oakland Scavenger Company) which serves virtually the entire County through exclusive franchises.

The present waste management system in Alameda County, like many others, consists of collection of garbage and refuse into packer trucks and haul to close-in disposal sites. The concentration of population in the metropolitan areas in the western portion of the County results in a centralized concentration of all forms of waste. Fewer and fewer acres of capacity at close-in sites remain available for landfill. Although today this is a disposal problem, it is also recognized as an opportunity for using the discarded materials in waste as a source of raw materials. The rapidly developing technology of resource and energy recovery and the continued cooperation of government and industry also creates many opportunities for improving inadequacies in today's waste management system.

The intent of the Nejedly-Z'Berg-Dills Solid Waste Management and Resource Recovery Act of 1972 was clearly to change waste disposal practices which cause environmental degradation and waste non-renewable resources. Thus, in recognition of these and other principles, the planning process in Alameda County is designed to provide a realistic foundation in fact and policy upon which rational choices for needed change may be made. Thus, through the application of social, institutional, and/or technical solutions, the Plan and its policies represent a beginning and an attempt to come to grips with all of the problems associated with waste management and to suggest cost-effective ways to accomplish these goals.

[1] Status of Solid Waste Management in California, 1968, California State Health Department.

B. Authority

In 1972, the California Legislature passed a unique bill introduced by Senator Nejedly (SB-5) known as the Nejedly-Z'Berg-Dills Solid Waste Management and Resource Recovery Act of 1972. With the passage of SB-5 , the Legislature expressed its awareness of, and intent regarding, the solid waste problem. The realization by the Legislature that the environmental problems we face arise from the inter-action of a number of factors, including rapid population increase, decentralized urban growth, industrial expansion, agricultural changes, transportation improvements, and technological developments in the manufacturing, packaging, and marketing of consumer products, which collectively are placing planning, economic, and resource base limitations upon the availability of land for solid waste disposal, set the stage for the development of local waste management plans. SB-5 established a State Solid Waste Management Board within the Resources Agency and the State Solid Waste Management and Resource Recovery Advisory Council within the Board; the legislation declares that the primary responsibility for adequate solid waste management and planning shall rest with the local government.

In order to fulfill the requirements of the Resources Code, SB-5 states that local government must prepare a "comprehensive, coordinated solid waste management plan for all waste disposal within the county and for all waste originating therein, which is to be disposed of outside the county." Local plans must be approved by a majority of the cities and population within the jurisdiction and submitted to the Board of January 1, 1976.

The State Solid Waste Management Board has adopted State Policy for solid waste management, including minimum standards for solid waste handling and disposal. The "Minimum Standards for Solid Waste Handling and Disposal" were incorporated into Title 14, Division 7, of the California Administrative Code, Sections 17200 to 17751. These standards were developed from Guidelines prepared by the Board for use by the counties in preparing their solid waste management plans. The State Policy outlines principles and objectives to promote the ". . . management of solid wastes in a manner which will protect the public health, safety, and well-being, protect the environment, and preserve our natural resources by the encouragement of source reduction of wastes and providing for the maximum reutilization and conversion to other uses of the resouces contained therein. . . ." The State Policy, minimum standards, and Guidelines provided guidelines for development of the Alameda County Solid Waste Management Plan.

C. Existing Solid Waste Management Systems

Collection presently accounts for nearly ninety percent of system costs because it is labor-intensive. Urban collection systems in Alameda County generally consist of three types of service: garbage collection (residential and commercial) by side and rear-end loader packer trucks, container service by front-end loader truck, and drop box service (industrial customers) by a "piggy-back" or drop box truck. Labor costs are the major cost component of

total collection costs; it accounts for over fifty percent of the collection operating costs. Collection cost increases with crew size and presently ranges from $66,470 per year for a 2-man crew to $102,470 per year for a 4-man crew.[1] Cost on a per-ton basis, which includes disposal charges, is between $30.99 per ton (2-man crew) and $47.77 per ton (4-man crew).

Collection routes are organized on a task-incentive (private industry) or a work day (municipal operations) basis. Alameda and Pleasanton franchise with small private operators for refuse service; Berkeley and San Leandro are municipal systems. The remaining cities or districts in the County are served by Oakland Scavenger Company, which operates 169 routes (112 residential/commercial, 19 front-end loader, and 38 drop box trucks). Oakland Scavenger Company organizes its routes on the basis of dollar volume of collection receipts so that each route generates the same income.

Collection rates for residential and commercial collection service ranges from $1.90 (Emeryville and Piedmont) to $2.90 (Hayward and Castro Valley) for weekly service to one 30-gallon can. In all jurisdictions, the rates for pick up of additional cans decreases with the number of cans. In Oakland, for example, the present initial charge is $2.40; the charge for the second can is only $1.60.

The subscriber to the refuse collection service is not only paying for the waste to be removed, but is also paying the disposal charges. Within the Oakland Scavenger Company, the collection divisions are charged varying rates by the dump operations service division of their company. San Leandro pays $3.25 to dump at Davis Street (Oakland Scavenger Company). Charges at the Eastern Alameda County Disposal Site on Vasco Road were raised recently (March 1, 1975) to $3.75 per ton. Disposal operations, because of their capital intensive nature, only account for ten to twenty percent of the total collection-disposal costs.

Fourteen jurisdictions have granted exclusive franchises to private firms for municipal refuse collection and some types of industrial waste collection. The franchise grants to the collector the exclusive privilege to collect all refuse in the local area. Local jurisdictions outline standards of service and rates in the contract with the firm. It is a responsibility of the local jurisdiction to establish rates based upon an analysis of the firm's costs and the determination of a fair rate of return. In recent years, the rate review process in the County has come under criticism by both the industry and local government as being inadequate.

D. Developments in Waste Management

Material handling technology has been applied to the problem of separation of various components in the waste stream with success. In contrast to landfill, technically proven and simple, materials separating machinery is technically sophisticated and intertwined in complicated economic relationships. The developing technology of resource and energy recovery was reviewed to determine feasibility for application in Alameda County.

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[1] Oakland Scavenger Company, 1974.

Several front-end systems, those which separate refuse into its components, were reviewed and could be applied in a large processing facility with some further testing and evaluation. Capital costs for such a system in conjunction with a transfer station are estimated at \$3.6 million; operating costs on an annual basis are estimated at \$1.7 million. These estimates are more fully examined in Sections V and VI.

The remaining organic fraction after removal of glass, ferrous metals, and non-ferrous metals can be used as a source of energy if burned or pyrolysized. It can also be composted and used as a soil builder. A study[1], conducted by Stanford Research Institute on various energy recovery processes, has singled out one pyrolysis process for further study. The results of that engineering feasibility study indicate that such a plant would probably be feasible with further full-scale testing, and that a large public investment (\$50 million) would be necessary to reduce costs significantly. Benefits would be in the form of a combustible gas or methane; there would be enough methane generated from the 1,750 ton-per-day plant to serve between ten and fifteen thousand households.

E. Implementation of Technical Alternatives

As a goal for 1976-1980 planning period, this plan designates a minimum of seven percent resource recovery (page V-42). This alternative, 1980-B, shows transfer and materials recovery for the northwestern portion of the County (Hayward to Albany). Other cities, such as Fremont, Newark, and Union City, may be brought into the system as transfer stations are built in Southern Alameda County.

Implementation of Alternative 1980-C (page V-43) would account for approximately sixty-seven percent resource recovery from solid waste by 1980. An energy recovery system is the key component to boosting the resource recovery rate and would have constraints mentioned above and in the Plan. While this system represents the optimum goal by 1980, many hurdles remain in the interim. Most obstacles are related to public financing while others relate to minor unresolved technical questions.

It should be noted that, even though cities in the Fremont area and in the Livermore Valley are not included in materials or energy recovery systems before 1980, that technical evaluations and feasibility studies during plan implementation should include information regarding recovery potential from these areas. In the short term, however, direct haul to landfills will continue.

Alternative Plans have been prepared for the years 1980 and 1990. Policies are included in the report through the year 2000.

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[1] Refuse as a Fuel for Utilities, prepared for Pacific Gas & Electric Company, San Francisco, by Stanford Research Institute, December, 1974.

ALTERNATIVE SYSTEMS, ALAMEDA COUNTY (TONS/YEAR)
1975 Existing 1980-1990 Proposed

Alternative	Generation/ Collection	Transfer	Materials Recovery	Energy Recovery	Long Haul	Disposal	Resource Recovery
1975 (Base Year)	1,083,400					1,083,400	0-2% ±
1980 - A[1]	1,190,600	883,000	112,300	680,600	88,100	387,300	67%
1980 - B[2]	1,190,600	870,600	87,100		783,500	1,103,500	7%
1980 - C[3]	1,190,600	870,600	87,100	713,000	70,500	390,500	67%
1990 - A[1]	1,445,800	1,445,800	589,900		1,075,700	637,600	41%
1990 - B[3]	1,445,800	986,400	98,600	807,900	79,900	539,300	63%
1990 - C[4]	1,445,800	1,445,800	144,600	1,184,100	117,100	117,100	92%
1990 - D[5]	1,445,800	1,274,900	127,500	1,044,100	103,300	274,200	81%

[1] Includes Bay Delta Resource Recovery Demonstration; 1980-A Demonstration, 1990-A Full Scale.

[2] Materials recovery in Central Metropolitan and Eden Planning Units only.

[3] Materials and energy recovery in CMPU and EPU only.

[4] Materials and energy recovery County-wide with two processing facilities and an energy recovery facility.

[5] Same as #4 but excluding the waste from the Livermore-Amador Planning Unit.

Summary of Cost Estimates of Alternative Solid Waste Management Systems: Alameda County, 1975, 1980, and 1990.

System	Total Capital Cost	New Capital Required[1]	Annual Operation Cost	Average Cost Per Ton[2]
1975 (Existing)	$ 18.8 M	$ 0.0 M	$43.1 M	$39.78
1980 - A	84.4 M	65.6 M	49.7 M	41.73
1980 - B	36.2 M	17.4 M	51.3 M	43.05
1980 - C	86.7 M	67.9 M	49.3 M	41.42
1990 - A	49.7 M	30.9 M	68.8 M	47.57
1990 - B	99.9 M	81.1 M	59.8 M	41.37
1990 - C	123.7 M	115.9 M	61.2 M	42.35
1990 - D	121.8 M	103.0 M	60.2 M	41.93

[1] Total capital less $18.8 million in the existing system assumed to continue in service.

[2] Includes depreciation on capital investment.

F. Summary of Recommended Policies

The goals and objectives and recommended policies found in Section VIII represent the culmination of the planning effort since January, 1973. The most important aspect of this Plan is its intended flexibility over the short, mid, and long range. In order to create a viable and meaningful plan, a series of five-year action programs from 1976 to 2000 are proposed. Each program consists of a series of elements which address problems of plan administration (including regulation and enforcement), management/operation, legal and legislative, finance, regional coordination,, public information, and research and planning.

Plan Administration

1. Plan administration and implementation should be assigned to existing County agencies on an interim basis. The Health Department should handle regulatory and enforcement activities and enforcement of the State Health and Safety Code; the Planning Department should handle planning functions in the unincorporated area; and the Zoning Administrator, and in the cities the responsible agency, should continue to review new and existing waste management activities for consistency and compliance with applicable laws and regulations as well as the policies

of the County-wide Waste Management Plan. A coordinator of waste management programs should be appointed; and, in addition to coordinating above mentioned activities, act as liaison with the cities to the County and to the State as required. Other County and city agencies may be required to participate in implementation on an as-needed basis.

2. In order to accomplish the city-County coordination necessary in this plan, a joint exercise of powers agreement should be executed between the County and all affected jurisdictions within the County. Such an agreement will be for the express purpose of accomplishing plan implementation and any other task which will benefit the community.

3. The assignment of implementing responsibility to existing County agencies in conjunction with a joint exercise of powers agreement, in order to achieve effective coordination with local jurisdictions, should constitute the interim County waste management agency. A separate board or commission with equal representation for cities and special districts and the County should be appointed to act in matters pertaining to waste management and plan implementation. The joint powers board could be so designated.

4. Regulation of waste management operations and enforcement of laws and regulations and the State-wide Minimum Standards for Solid Waste Management should be assigned to the County Health Department and Zoning Administrator until such time that a separate enforcement body is needed or formed.

5. Modification of State standards to apply in Alameda County may be necessary by the County waste management agency.

6. A comprehensive waste management ordinance should be developed for adoption by all local jurisdictions. (One has been prepared by staff for review.)

7. Evaluation of current waste management activities of collection, resource recovery, and disposal should be further evaluated as to costs and revenues. Audit paths suggested in the Price Waterhouse Study of 1972 should be implemented immediately.

Management/Operations

1. Waste management functions which are best managed (effective and efficient) by private industry should remain with the industry. However, all parts of the solid waste system, including materials recovery, energy recovery, and disposal should continue to be evaluated by the County waste management agency to determine if public ownership or another private company would be more efficient and less costly. Where legal requirements or the public sentiment dictate questionable return on investments or large capital expenditures in the case of resource or energy recovery, public financing and/or operation of the system is suggested and should be carefully evaluated.

2. Each jurisdiction should retain jurisdictional authority for refuse removal services. Transfer and processing facilities, long haul, and disposal sites existing or proposed should be in conformance with the Plan. Cities and special districts should be able to rely upon the County waste management agency for assistance in evaluating the waste system and services as well as new facilities location.

3. A resource recovery facility or facilities serving the metropolitan area (Central Metropolitan, Eden, and Washington Planning Units) of Alameda County should be built in a central location. Such a facility would separate ferrous and non-ferrous metals, re-usable fibers (wood and paper), glass, and other materials for which markets exist. It would apply the most modern technology to this problem. With respect to resource recovery, industry and the public should be encouraged or required to separate wastes into components which can be sold or re-used as secondary materials. An example of this is waste wood from industries which could be recovered and sold to kraft paper manufacturers.

4. The closing of close-in disposal sites will necessitate the location of satellite transfer stations throughout the County. The location of these transfer stations and the central processing facility should be carefully examined for efficiency and cost effectiveness.

5. Barriers which restrict the flow of wastes to or from one part of the County to another should be removed. Comprehensive waste management planning may necessitate the use of resources in waste or facilities in order to preserve future options for optimum systems.

Legal and Legislation

1. A review of a draft model ordinance should be expedited as a high priority during Plan implementation.

2. Application on a County-wide basis of a Litter Control and Bottle Bill should be evaluated.

3. A legislative review program should be established to address problems which can be resolved by changes in State and Federal laws and policies. This includes many areas but is exemplified by the problems faced by the secondary materials industry in inequity in taxes and tariffs.

Finance

1. Questions about revenues generated through user charges and rates in each jurisdiction should be evaluated. Audit procedures suggested by the Price Waterhouse Study of 1972 should be adopted as well as a model agreement as drafted by the Joint Refuse Rate Committee. Questions concerning rate of return or return on investment should be resolved at the earliest date.

Regional Coordination

1. Solutions to common problems shared by sister counties in the Bay Area should be evaluated; such problems would be, for example, landfill capacity and resource recovery potential, import and export of waste, and hazardous waste management.

2. Participation in regional studies through ABAG of common waste management problems should continue and be encouraged.

Public Information

1. A public information and education program should be an integral part of the Plan and implementation. This would occur through media packages, forums, and school education programs. One goal of such a program would be to reduce the volume of waste generated.

Research and Planning

1. A plan review program should be established for updating the Plan every three years.

2. Research in the area of resource and energy recovery should be monitored; funding requirements and feasibility for local application should be determined and reported.

3. Proposals for funding capital and research projects should be prepared.

4. Resource recovery potential within each jurisdiction should be evaluated. Methods which involve application of technological solutions and attitudes and customs should be considered.

II. EXISTING SOLID WASTE MANAGEMENT SYSTEMS IN ALAMEDA COUNTY

A. Characteristics of Alameda County

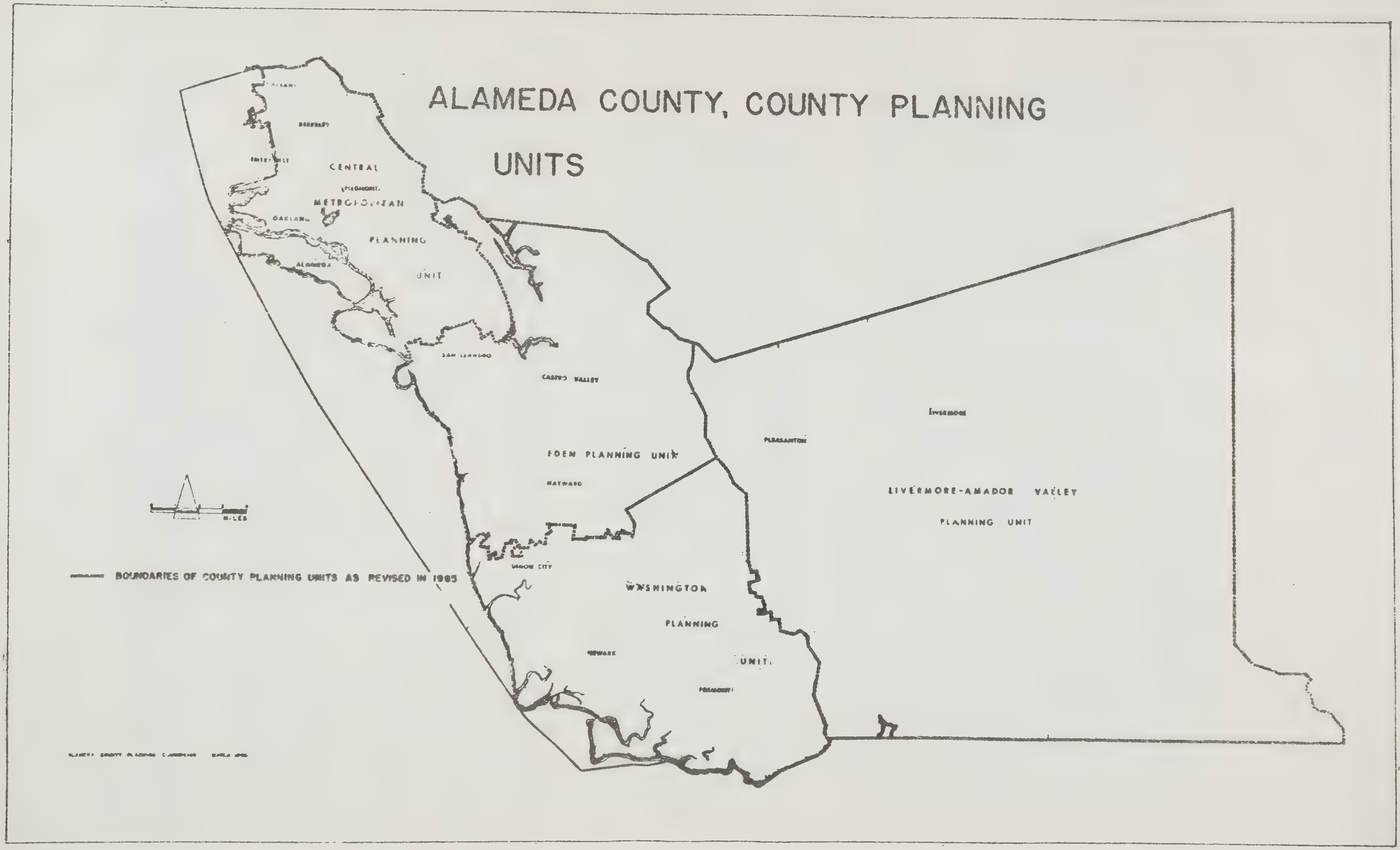
Alameda County, with 13 cities, 735 square miles of land, and 77 square miles of water, is one of the Bay Area's rapidly growing and diverse counties. Geographically, the County consists of a 36-mile-long coastal plain that varies in width from 3 miles at the northern end to 8 miles at the southern end. The East Bay Hills, rising to elevations of 3,000 feet, divide the coastal plain from the Livermore-Amador Valley, a bowl-shaped area surrounded by gently rolling hills of the Diablo Range. Elevations range from sea level to 3,807 feet in the mountainous area in the southeastern portion of the County. Several geologic faults exist, and there are 7 different soil types represented throughout. Vegetation varies from coastal salt marsh to green sclerophyll forest to semi-arid and arid grassland. Alameda County represents an area of California noted for its plant endemism, and there are at least 12 rare or endangered species of plants within its boundaries.

The County is divided into two geographical units by the foothills east of the cities of Berkeley, Oakland, Hayward, and Fremont. The Livermore Valley is connected to the coastal plain by three passes: Dublin Canyon, Niles Canyon, and Mission Pass. The Livermore Valley constitutes the eastern portion of the County, has a small by rapidly growing population, and still supports a significant amount of agricultural activity. While the major portion of population and urbanization occurs in the northern cities of Alameda County, the fastest growth is in the southwestern portion of the County, from San Leandro to Fremont. Rapid population increases have also been occurring in the Livermore-Amador Valley.

Alameda County had a January, 1975, estimated total population of 1,142,000 people distributed within four Planning Units. The Central Metropolitan Planning Unit includes the cities of Albany, Berkeley, Piedmont, Oakland, and Emeryville, with an estimated January, 1975, population of 576,000 people representing 50.5 percent of the total population of the County. It includes 51,030 acres of land. South of the Central Metropolitan Planning Unit, and west of the hills that separate the western portion of the County from the Livermore-Amador Valley, are the Eden and Washington Planning Units.

Eden Planning Unit includes the cities and unincorporated areas of Hayward, San Leandro, Castro Valley, San Lorenzo, and Rural Recreation Areas 1 and 2. The area has an estimated January, 1975, population of of 276,100 people, representing 24.2 percent of the population of the County. Eden Planning Unit encompasses 76,430 acres of land.

Washington Planning Unit, which includes the cities of Fremont, Newark, and Union City, and Rural Recreation Area 3, has an estimated January, 1975, population of 182,900 people, representing 16.0 percent of the population of the County. Washington Planning Unit has a total of 79,280 acres.


ALAMEDA COUNTY, COUNTY PLANNING UNITS
CENTRAL METROPOLITAN PLANNING UNIT
OAKLAND
ALAMEDA
CASTRO VALLEY
EDEN PLANNING UNIT
PLEASANTON
LIVERMORE-AMADOR VALLEY PLANNING UNIT
UNION CITY
WASHINGTON PLANNING UNIT
MILES
BOUNDARIES OF COUNTY PLANNING UNITS AS REVISED IN 1965

Finally, the Livermore-Amador Valley Planning Unit encompasses the eastern portion of the County, and includes the cities of Livermore and Pleasanton, and unincorporated areas of Dublin, Sunol, and Rural Recreation Areas 4 and 5. This valley is 264,530 acres in size and has an estimated January, 1975, population of 106,400 people, representing 9.3 percent of the population of the County. Each of these four planning units is characterized by unique natural features. Land use types, population composition, and characteristics vary in each of the four areas.

B. Solid Waste Generation in Alameda County

Most human activities result in the generation of solid waste. Significant community activities may be categorized as productive, such as manufacturing of durable and non-durable goods; consumptive, such as household, commercial, financial, and business activities; and generative, such as agriculture, mining, and demolition.[1] Waste may also be defined by its source, as it is for example in the 1968 State Public Health report on the Status of Solid Waste Management in California.[2] (See Table II-4.) The latter represents a sound approach to the definition of wastes which must be managed and has been adapted for use in this study.

At the outset of this inquiry, it should be recognized that a methodological dilemma exists which cannot be easily resolved. While it is apparent that there are many ways of defining waste sources and characteristics, there are just as many methods for establishing or defining quantitative waste flow from producer to landfill. An attempt is made herein to resolve the dilemma by circumventing the specific problem of pinpointing waste flows at the neighborhood and census tract level at this time in favor of defining the problem at the next higher level, the planning unit or disposal service area. At this level, the discussion of waste quantities are made by disposal service area and/or planning unit. In the future, it is anticipated that the next level of resolution will be cities or franchises or collection routes which would then accomplish a more complete, detailed picture of waste generation within each planning unit.

Another dilemma exists concerning the quantitative estimation of waste in Alameda County. There is a discrepancy of about 40 percent to 50 percent between the estimate of waste produced as presented in the State Public Health report and the quantities of waste that the refuse industry collects and disposes in local landfills. Each estimate is correct for its own purpose. In this plan, both will be presented, while the latter will be used as a realistic basis for estimating future waste generation. Forecasts of waste generation must have flexibility in allowing for growth and technological and social changes.

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[1] For a more detailed description of establishing waste generation data, see Methods of Predictive Solid Waste Characteristics, Gail B. Boyd & Myron B. Hawkins, URS Research, San Mateo, CA, USEPA Report SW-23c, 1971, Contract No. PH86-68-98.

[2] Status of Solid Waste Management in California, 1968, California State Department of Public Health, Berkeley, September, 1968.

An evaluation of the total quantities of municipal, agricultural, and industrial wastes generated in 1967 in each of the 58 counties in California was made in the State Public Health Study.[1] Municipal wastes include residential wastes, commercial, demolition, and special or street sweepings and city tree prunings. In Alameda County in 1967, the largest portion of solid waste fell into this category (72.4 percent), with an estimated 1,347,000 tons per year ranking Alameda County fourth in the State. Municipal wastes, including waste from residential, commercial, demolition, and city sources, constitute the major portion of the waste that is collected and disposed in landfills within the County.

1. General Wastes:

Municipal Wastes

The composition of solid wastes varies with the source from which it is generated. Domestic household rubbish and garbage, along with commercial wastes from institutions, hospitals, restaurants, hotels, stores, offices, and markets, constitute the largest portion of the disposal problem faced in Alameda County (see Table II-8). It has been estimated that 72.4 percent of the total waste produced in Alameda County consists of residential and commercial waste.[2] Industrial wastes from food processing industries, lumber, chemical and petroleum, and heavy manufacturing processes comprise an additional 20.9 percent. Agricultural wastes from such sources as feedlots, fruit and nut crops, and field and row crops account for the remaining 6.7 percent. Solid wastes, then, may be defined as having a Municipal, Industrial, or Agricultural point of origin. The composition of municipal waste from urban sources is shown in Table II-1.

Agricultural Wastes

Agricultural waste is that associated with the production of crops of fruits and nuts; field and row crops; and beef, pork, lamb, or chicken meats for human consumption. These types of waste are distinctly separate from cannery and other food processing wastes, since most of them are produced in the field and disposed of in the same location. Feedlot and abattoir wastes do, however, constitute a significant problem, both in terms of bulk quantities of waste and potential threat to ground and surface water quality. The composition of agricultural wastes is outlined in Table II-3.

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[1] Status of Solid Waste Management in California, 1968, California State Department of Public Health, Berkeley, September, 1968.

[2] Ibid.

Agricultural wastes are not a large problem in Alameda County, since most are biodegradable and disposed of at, or near, the point of origin. Little, if any, finds its way to the landfills. None is burned due to air pollution regulations, unless declared a disease hazard. The County produced an estimated 125,000 tons of agricultural waste in 1967.[1] Agricultural wastes consist of animal manures, fruit and nut crop waste, and field and row crop waste; these categories also include the wastes which arise from the production of cut flowers and nursery plants. Animal manures are a major contributor to the agricultural waste problem. State Public Health report figures for 1967 estimate that about 59,000 tons of manures from feedlots, chicken ranches, and other sources were produced in the County and were disposed of in place or stockpiled. The majority of the fruit and nut and field and row crops that are grown in Alameda County are field packed and the waste put right back into the soil where the harvesting occurs. This factor, along with a general decline in agricultural production in the County, may account for the small amount which ends up in landfill sites.

Concomitant with the general decline in agriculture and agricultural production in the County is a decline in the agricultural waste production. Statistics substantiating the decline in agricultural production are found in the annual Agricultural Crop Report published by the County Agricultural Commissioner's office. Using 1967 as a base year, figures presented in the Crop Reports indicate that, with the exception of nursery crops and cut flowers, which have shown a net increase in production, all other crops have shown a decline. For example, field crops, such as barley, wheat, hay, safflower, and other grains have shown diminished acreages on the order of 21.43 percent from 1967 to 1972. Vegetable crop acreage has declined by 50.1 percent and fruit and nut crop acreage has declined by 18.4 percent in the same time span. Other data reflect a 12.4 percent decrease in all inventories of cattle and calves, a 74.6 percent decrease in sheep and lambs, a 76.04 percent decrease in hogs and pigs, and a 34.82 percent decrease in hens and pullets between 1968 and 1972. Thus, agricultural wastes are expected to be of minor concern in the overall waste management scheme due to their biodegradability and the local decline in agricultural activities.

Industrial Waste

Industrial waste, while only about 21 percent of the problem in the County, constitutes the highest potential threat to environmental degradation. The California State Water Resources Control Board has

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[1] Status of Solid Waste Management in California, 1968, California State Department of Public Health, Berkeley, September, 1968.

TABLE II-1 COMPOSITION OF MUNICIPAL SOLID WASTES FROM URBAN SOURCES[1]

Urban Sources	Waste	Composition
Domestic, household	Garbage	Wastes from preparation, cooking and serving of food; market wastes from handling, storage, and sale of food.
	Rubbish, trash	Paper, cartons, boxes, barrels, wood, excelsior, tree branches, yard trimmings, metals, tin cans, dirt, class, crockery, minerals.
	Ashes	Residue from fuel and combustion of solid wastes.
	Bulky wastes	Wood furniture, bedding, dunage, metal furniture, refrigerators, ranges, rubber tires.
Commercial, institutional, hospital, hotel, restaurant, stores, offices, markets	Garbage	Same as domestic.
	Rubbish, trash	Same as domestic.
	Ashes	Same as domestic.
	Demolition wastes, urban renewal, expressways	Lumber, pipes, brick masonry, asphaltic material and other construction materials from razed buildings and structures.
	Construction wastes, remodeling	Scrap lumber, pipe, concrete, other construction materials.
	Special wastes	Hazardous solids and semi-liquids, explosives, pathologic wastes, radioactive wastes.
Municipal, streets, sidewalks, alleys, vacant lots, incinerators, power plants, sewage treatment plants, lagoons, septic tanks	Street refuse	Sweepings, dirt, leaves, catch basin dirt, contents of litter receptacles, etc.
	Dead animals	Cats, dogs, horses, cows, marine animals, etc.
	Abandoned vehicles	Unwanted cars and trucks left on public property.
	Fly ash, incinerator residue, boiler slag	Boiler house cinders, metal scraps, shavings, minerals, organic materials, charcoal, plastic residues.
	Sewage treatment residue	Solids from coarse screening and grit changers, and sludge from settling tanks.

[1] SOURCE: Solid Waste Management: A Comprehensive Assessment of Solid Waste Problems, Practices, and Needs, Office of Science and Technology, Executive Office of the President, Washington, DC, May, 1969.

established rigid standards for the disposal of industrial wastes and particularly hazardous solid and liquid wastes.[1] Land disposal of industrial solid and liquid hazardous wastes is subject to control and inspection by the local Water Quality Control Board, as well as local Planning and Health Officials. Strict measures must be taken to confine such waste and be confirmed by regular periodic testing and analysis of a site to insure that none of the materials disposed of at the site, or any of the products of decomposition, will degrade the ground or surface water, and that none of the materials will be deleterious to the health of the waste handlers or residents of the County.

Industrial wastes in Alameda County were estimated at 388,000 annual total tonnage for four broad categories: (1) food processing waste, (2) lumber industry waste, (3) chemical and petroleum industry waste, and (4) light and heavy manufacturing wastes. Food processing or cannery waste is produced seasonally. A large portion of the cannery waste is disposed outside the County where it is spread on the ground and disced into the soil. Four categories of manufacturing account for most of the solid waste produced and are considered "major waste producing industries." They are: (1) primary metal working or smelting, (2) stone, clay, glass, and concrete products, (3) machinery manufacturing, and (4) transportation equipment manufacturing.

Table II-2 presents the industrial sources and the types or composition of waste from these sources by Standard Industrial Code Classification. A more definitive treatment of the acceptable waste disposal requirements will appear in subsequent sections of this report.

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[1] Status of Solid Waste Management in California, 1968, California State Department of Public Helath, Berkeley, September, 1968.

TABLE II-2 SOURCES AND TYPES OF INDUSTRIAL WASTES[1]

Code	S.I.C. Group Classification	Waste generating processes	Expected specific wastes
17	Plumbing, heating, air conditioning Special Trade Contractors	Manufacturing and installation in homes, buildings, and factories	Scrap metal from piping and duct work; rubber, paper, and insulating materials, misc. construction and demolition debris
19	Ordinance and accessories	Manufacturing and assembling	Metals, plastic, rubber, paper, wood, cloth, and chemical residues
20	Food and kindred products	Processing, packaging, and shipping	Meats, fats, oils, bones, offal vegetables, fruits, nuts and shells, and cereals
22	Textile mill products	Weaving, processing, dyeing, and shipping	Cloth and fiber residues
23	Apparel and other finished products	Cutting, sewing, sizing, and pressing	Cloth and fibers, metals, plastics, and rubber
24	Lumber and wood products	Sawmills, mill work plants, wooden container, misc. wood products, manufacturing	Scrap wood, shavings, sawdust; in some instances metals, plastics, fibers, glues, sealers, paints, and solvents
25	Furniture, wood	Manufacture of household and office furniture, partitions, office and store fixtures, and mattresses	Those listed under Code 24, and in addition cloth and padding residues
25	Furniture, metal	Manufacture of household and office furniture, lockers, bedsprings, and frames	Metals, plastics, resins, glass, wood, rubber, adhesives, cloth, and paper
26	Paper and allied products	Paper manufacture, conversion of paper and paperboard, manufacture of paperboard boxes and containers	Paper and fiber residues, chemicals, paper coatings and fillers, inks, glues, and fasteners
27	Printing and publishing	Newspaper publishing, printing, lithography, engraving, and bookbinding	Paper, newsprint, cardboard, metals, chemcals, cloth, inks, and glues
28	Chemicals and related products	Manufacture and preparation of inorganic chemicals (ranges from drugs and soups to paints and varnishes, and explosives)	Organic and inorganic chemicals, metal, plastics, rubber, glass, oils, paints, solvents and pigments
29	Petroleum refining and related industries	Manufacture of paving and roofing materials	Asphalt and tars, felts, asbestos, paper, cloth, and fiber

[1]Solid Waste Management: A Comprehensive Assessment of Solid Waste Problems, Practices, and Needs, Office of Science and Technology, Executive Office of the President, Washington, DC, May, 1969.

TABLE II-2 SOURCE AND TYPES OF INDUSTRIAL WASTES[1] (Cont.)

Code	S.I.C. Group Classification	Waste generating processes	Expected specific wastes
30	Rubber and miscellaneous plastic products	Manufacture of fabricated rubber and plastic products	Scrap rubber and plastics, lampblack, curing compounds, and dyes
31	Leather and leather products	Leather tanning and finishing; manufacture of leather belting and packing	Scrap leather, thread, dyes, oils, processing and curing compounds
32	Stone, clay, and glass products	Manufacture of flat glass, fabrication or forming of glass; manufacture of concrete, gypsum, and plaster products; forming and processing of stone and stone products, abrasives, asbestos, and mics. nonmineral products	Glass, cement, clay, ceramics, gypsum, asbestos, stone, paper, and abrasives
33	Primary metal industries	Melting, casting, forging, drawing, rolling, forming, and extruding operations	Ferrous and nonferrous metals scrap, slag, sand, cores, patterns, bonding agents
34	Fabricated metal products	Manufacture of metal cans, hand tools, general hardware, nonelectric heating apparatus, plumbing fixtures, fabricated structural products, wire, farm machinery and equipment, coating and engraving of metal	Metals, cermaics, sand, slag, scale, coatings, solvents, lubricants, pickling liquors
35	Machinery (except electrical)	Manufacture of equipment for construction, mining, elevators, moving stairways, conveyors, industrial trucks, trailers, stackers, machine tools,	Slag, sand, cores, metal scrap, wood, plastics, resins, rubber, cloth, paints, solvents, petroleum products
36	Electrical	Manufacture of electric equipment, appliances, and communication apparatus, machining, drawing, forming, welding, stamping, winding, painting, plating, baking, and firing operations	Metal scrap, carbon, glass, exotic metals, rubber, plastics, resins, fibers, cloth residues
37	Transportation equipment	Manufacture of motor vehicles, truck and bus bodies, motor vehicle parts and accessories, aircraft and parts, ship and boat building, and repairing motorcycles and bicycles and parts, etc.	Metal scrap, glass, fiber, wood, rubber, plastics, cloth, paints, solvents, petroleum products

[1] Solid Waste Management: A Comprehensive Assessment of Solid Waste Problems, Practices, and Needs, Office of Science and Technology, Executive Office of the President, Washington, DC, May, 1969.

TABLE II-2 SOURCE AND TYPES OF INDUSTRIAL WASTES[1] (Cont.)

Code	S.I.C. Group Classification	Waste generating processes	Expected specific wastes
38	Professional, scientific controlling instruments	Manufacture of engineering, laboratory, and research instruments and associated equipment	Metals, plastics, resins, glass, wood, rubber, fibers, and abrasives
39	Miscellaneous manufacturing	Manufacture of jewelry, silverware, plated ware, toys, amusement, sporting and athletic goods, costume novelties, button, brooms, brushes, signs, and advertising displays	Metals, glass, plastics, resins, leather, rubber, composition bone, cloth, straw, adhesives, paints, solvents

[1] Solid Waste Management: A Comprehensive Assessment of Solid Waste Problems, Practices, and Needs, Office of Science and Technology, Executive Office of the President, Washington, DC, May, 1969.

TABLE II-3 COMPOSITION OF SOLID WASTES FROM AGRICULTURAL SOURCES[1]

Agricultural Source	Waste	Composition
Farms, ranches, greenhouses, livestock feeders, and growers	Crop residue	Cornstalks, tree prunings, pea vines, sugarcane stalks (bagasse), green drop, cull fruit, cull vegetables, rice, barley, wheat and oats stubble, rice hulls, fertilizer residue
	Forest slash	Trees, stumps, limbs, debris
	Animal manure (Paunch manure)	Ligneous and fibrous organic matter, nitrogen, phosphorus, potassium, volatile acids, proteins, fats, carbohydrates
	Poultry manure	Same as animal manure
	Animal carcasses, flesh, blood, fat particles, hair, bones, oil, grease	Ammonia, urea, amines, nitrates, inorganic salts, various organic and nitrogen-containing compounds
	Pesticides, insecticides, herbicides, fungicides, vermicide and microbicide residues and containers	Chlorinated hydrocarbons, organo-phosphorus compounds, other organic and inorganic substances, e.g., strychnine and lead arsenate

[1] Solid Waste Management: A Comprehensive Assessment of Solid Waste Problems, Practices, and Needs, Office of Science and Technology, Executive Office of the President, Washington, DC, May, 1969.

2. Solid Waste Generation by Planning Unit:

The most reasonable starting point for discussion of Solid Waste Generation is the study that was prepared by the California State Department of Public Health in 1968 on the Status of Solid Waste Management in California.[1] In this report, solid waste is categorized into industrial, municipal, or agricultural sources and are further broken down by types of wastes according to sources, as shown in Table II-4, "Annual Total Solid Waste Production by Components in Alameda County, California, 1967." This table reflects the estimated solid waste production in Alameda County by source. Waste production figures shown here were derived from a per capita per day, or pounds per animal per year, or a tons per acre per year, or number of employees, or percentage of raw materials processed, or a tonnage per production unit basis. The methodology used by the State based upon production factors was justified since

> ". . . it was determined that solid waste quantities, when related to specific sources of generation, provide a better basis for future projections. Advantages of this method are that it takes into account: (a) different growth rates of various sources of waste generation, (b) technological changes affecting specific sources and types of waste, (c) more detailed information concerning the various streams of waste (e.g., waste factors can be developed for specific sources)."[2]

These total waste production estimates are from 40 to 50 percent greater than the estimates and weighings made by the refuse removal industry at local landfills recently.

Reconciliation of the discrepancy, which exists between the total waste production estimates made by the State in 1967-68, and current industry surveys and estimates presented in Table II-6 and II-7, may not be entirely possible because of the impossibility in accounting for source reduction. The waste flow from source activity to disposal may be demonstrated in a rough materials balance equation (Fig. II-2). Depending upon the method used to estimate waste loading, the amount of waste that reaches the landfill may vary from 40 to 60 percent of the total generated by source activities. Examples of the losses in this system may be due to errors in estimation of the totals, source reduction and/or separation, and resource recovery. In addition, the system must take into account the durable goods produced which may not become waste until they breakdown or wear out.

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[1] Status of Solid Waste Management in California, 1968, California State Department of Public Health, Berkeley, September, 1968.

[2] Ibid.

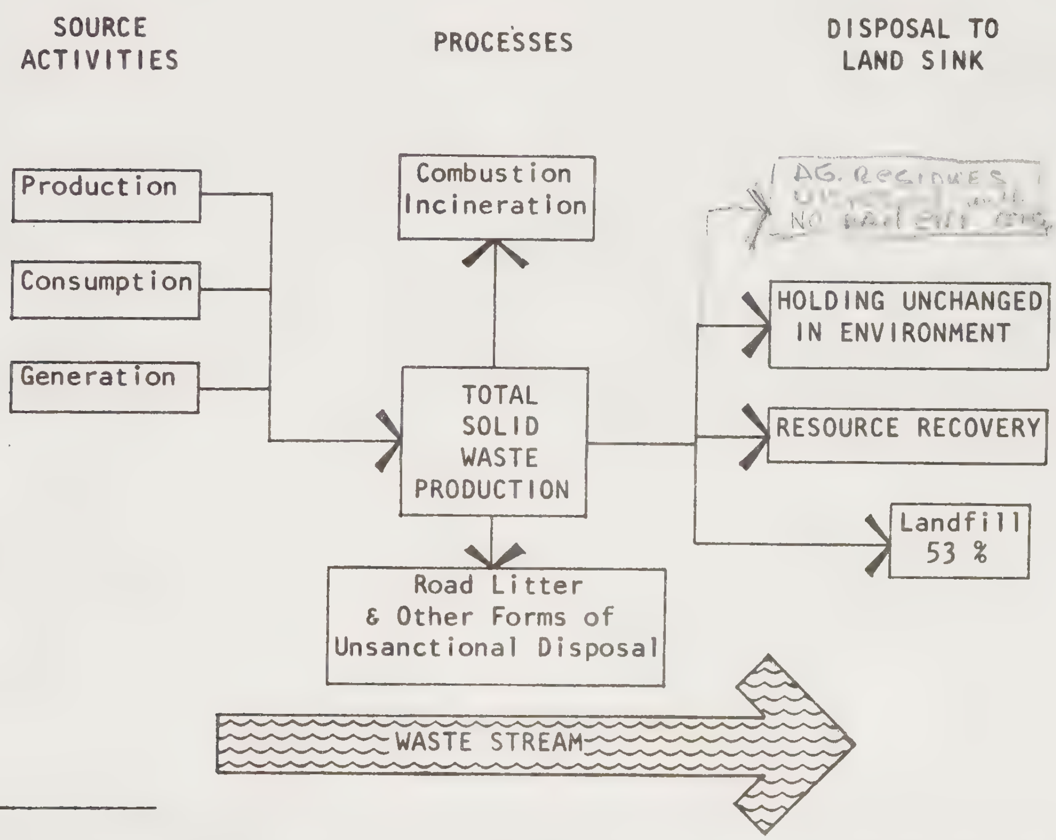
TABLE II-4 ANNUAL TOTAL SOLID WASTE PRODUCTION BY COMPONENTS IN ALAMEDA COUNTY, CALIFORNIA, 1967[1]

	Tons/Year	1968 Lbs/Cap/Day	1975 @ 1%/Yr
I. Municipal Wastes			
a. Residential	477,900	2.441	2.643
b. Commercial	582,100	2.973	3.22
c. Demolition	202,000	1.031	1.12
d. Special	84,900	0.433	.469
Annual Total Tonnage:	1,347,000	6.87	7.44
Rank in State:	4		
II. Agricultural Wastes			
a. Livestock Manure	58,900		
b. Fruit and Nut Crop Waste	8,300		
c. Field and Row Crop Waste	57,500		
Annual Total Tonnage	125,000	NA	NA
Rank in State:	37		
III. Industrial Solid Wastes			
a. Food Processing Waste	151,900		
b. Lumber Industry	16,700		
c. Chemical and Petroleum Industry	11,000		
d. Manufacturing			
Heavy	155,900		
Light	52,900		
Annual Total Tonange	388,000	1.98	2.14
Rank in State:	7		
	TOTAL	8.85	9.58

[1] Calculations based upon information in Status of Solid Waste Management in California, 1968, California State Department of Public Health, Berkeley, September, 1968.

Because of differences in generation factors and methods of reporting, it is difficult to break down the agricultural and industrial waste generation figures from the State Report in Table II-4 by Planning Unit. Most industrial activity is concentrated in the Central Metropolican Planning Unit, while most agricultural production is confined to the Washington and Livermore-Amador Planning Units. It is apparent in Table II-1 that the majority of the waste that is generated is in the municipal waste category. Per capita municipal waste generation figures derived from the 1968 Public Health Estimates are shown in Table II-5, broken down into waste production by planning unit in 1968 and 1975. These data show the expected municipal waste loading in the County per day. Part B of Table II-5 is a revised estimate of waste production for 1975, prepared by the County. The estimate assumes a one percent per year increase in waste generation and is based upon Alameda County Planning Department population projections for 1975.[1]

FIGURE II-1 MATERIALS BALANCE EQUATION FROM SOURCE TO LAND SINK



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[1] Preliminary Population Projections to 1990 Alameda County Planning Department 11/72

TABLE II-5 MUNICIPAL WASTE GENERATION 1968 & 1975

A. Municipal Wastes in Tons/Day, 1968 Base Estimate

	CMPU	Eden	Wash.	LAPU	
Residential	704.86	335.37	172.87	94.78	1,307.88
Commercial	858.47	408.47	212.90	115.43	1,595.27
Demolition	297.71	141.65	73.83	40.3	553.49
Special	125.03	59.49	31.00	16.81	232.33
Daily Total Tonage	1,986.07	944.98	470.60	36.59	3,453.24

B. Municipal Wastes in Tons/Day, 1975 Estimate @ 1%/Yr Increase

Residential	773.07	376.6	239.19	136.1	1,524.96
Commercial	941.85	458.35	291.41	165.83	1,857.94
Demolition	327.6	159.6	101.36	57.68	646.24
Special	137.18	66.83	42.44	24.15	270.6
Daily Total Tonage	2,173.7	1,061.91	674.4	383.77	4,293.78

Local refuse collectors have completed two studies of amounts of waste going to their landfills. Oakland Scavenger Company, one of the largest private collectors nationally, published estimates (Table II-6) of waste loading by disposal service area in May, 1973. Their estimates indicate that approximately 2,664.5 tons of waste per day are collected for disposal County-wide. Without considering metropolitan and urban or seasonal variations which occur[1] in waste generation, this is 4.96 pounds per day per capita of the total amount of waste generated that ends up in local landfill sites.

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[1] Systems Analysis for Solid Waste Disposal by Incineration, FMC Machine Systems Group, FMC Corp., Santa Clara, CA 1968. Discussion of seasonal variations in waste loading as well as differences attributable to different residential densities and industries is contained in this report.

TABLE II-6

Estimate of Waste Generation by Disposal Service Area
by the Refuse Removal Industry[1]

City(s)	Population Base	Quantity		
		Tons/Yr	Tons/Day	Acre Feet Per Year
Unit I				
Albany Emeryville Oakland Piedmont San Leandro (Part)	435,750	385,200	1,054.8	478
Unit VI				
Berkeley	116,500	120,000	328.8	127
Unit V				
Alameda	76,100	67,300	184.4	84
Unit II				
Castro Valley Hayward San Leandro (Part)	238,200	184,400	505.2	238
Unit I				
Fremont Area Newark Union City Area	181,600	140,600	385.2	182
Unit IV				
Livermore Area Dublin-San Ramon	65,700	50,900	139.5	66
Unit VII				
Pleasanton Area	31,400	24,300	66.6	32
	1,145,250	955,700	2,664.5	1,207

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[1]Source: Oakland Scavenger Company, Estimate of Solid Wastes Generated in Alameda County, 1973. Disposal service areas set up by the industry do not conform to the four planning units in the county because the cities of Berkeley and San Leandro have a municipal collection system while the other cities in the county operate under a franchise with a private collector.

3. Identification of Selected Special Wastes:

In addition to residential, commercial, and agricultural wastes previously discussed, there are several types of waste materials being generated in Alameda County which present several problems in handling and disposal. These special wastes are significant aspects of the total solid waste stream due to such characteristics as being hazardous (to the public health), putrescible, or visible; having a high moisture content; creating potential for serious environmental pollution; and being generated in large quantity. Special wastes may be defined as including the following materials: autos, tires, bulky items, semi-solids, liquids, slurries and sludges, domestic animal wastes, hazardous wastes, and litter.

In Alameda County, hazardous wastes, sewage treatment residues (sludge), food processing residuals, junk vehicles, and litter have been examined in detail because they are the most significant of the special wastes in the County and, therefore, merit close examination. The other special wastes are also important but are beyond the scope of the present study of solid waste generation for the development of this plan.

a. Hazardous Wastes:

The term "hazardous waste" has several definitions in the available literature and in Federal and State Law. Basically, these wastes are capable of causing severe personal injury or illness or even death as a result of direct skin contact, inhalation and ingestion, or as a result of improper disposal procedures. Contamination of soils and surface and ground waters as well as injury to wildlife may also result from improper and uncontrolled land disposal. Characteristics of hazardous wastes include the properties of toxicity, corrosiveness, flammability, irritation, and infection. Materials such as medical wastes, industrial waste chemicals and sludges, radioactive wastes, explosives, and used pesticide containers require special handling and disposal techniques in order to protect the public health and environment.

The County's investigation of hazardous wastes focused on hazardous waste generation and disposal by industrial and non-industrial sources. Industrial sources are primarily the chemical and manufacturing industries. Non-industrial sources include medical facilities, sewage pumpers, and pesticides and their used containers. Information presented here is mainly qualitative in nature due to the great lack of definitive and reliable quantitative data on manufacturing waste of any type.

Description of Industrial Sources of Hazardous Wastes in Alameda County

Industry produces a variety of hazardous wastes which require special handling and disposal in order to protect the public health and the environment. These wastes include dusts, sludges, caustics, acids,

solvents, paints, contaminated wash water, and chemicals. Disposal of these materials to a sewer, incinerator, or land disposal site is regulated by Federal and State legislation and by local sanitary district and health ordinances. Industrial sources of hazardous wastes are identified by their parent operations categorized in the Standard Industrial Classification Manual, 1972, abbreviated SICC.

Data from California Employment and Payrolls by the California Department of Human Development, January-March, 1972, indicates the following distribution of companies in hazardous waste generating industries in Alameda County identified in a State Public Health Department study on hazardous waste:

. Primary Metal Manufacture:	55
. Metal Fabrication:	625
. Textile Mill Products:	12
. Leather Products:	9
. Petroleum Refining (and Related Industries):	14
. Chemical Production:	96
	811

These 811 industries with 45,259 employees represent 58.6 percent of the total manufacturing employment of Alameda County in 1972. The 1973 Directory of Manufacturers and Wholesalers prepared by the Alameda County Chamber of Commerce indicates there are 22 Metal Finishing companies and 7 Pesticide and Agricultural Chemical Manufacturers in Alameda County.

Table II-7 describes the characteristics, composition, and associated hazards of several types of industrial waste products. Land disposal of these materials must occur at a Class I disposal site.

At the present time, industrial wastes are being deposited rather indiscriminately at disposal sites in Alameda County. Industrial liquid wastes which are either toxic or capable of impairing the quality of ground and surface waters are primarily deing disposed at Class I sites located in Contra Costa County. However, illegal dumping of these hazardous materials, to sewers or streams or abandoned lots by "midnight haulers" occurs, according to Alameda County Health Officials. Some of these hazardous materials are being dumped at Class II sites. A general survey of Class II sites in Alameda County by the State Department of Public Health in 1972 indicated that foundry dust was being disposed at the Berkeley Landfill site. That same site once accepted dynamite for disposal, yet it has no methods for handling hazardous waste. Asbestos, a well-known hazard to health, it classified as a Group 3 waste and is permitted at Class II and III sites.

TABLE II-7 EXAMPLES OF HAZARDOUS INDUSTRIAL WASTES[1]

SOURCE	SICC	NUMBER IN COUNTY	TYPE OF WASTE	CHARACTERISTICS OR COMPOSITION	ASSOCIATED HAZARDS
Textile Mill Products	22	12	Dye wastes, cotton finishing wastes, asbestos	Dichromate - acetic acid, tin and iron salts, dye pigments, bleach, fungicide, asbestos fibers	Corrosive to human skin, possible carcinogens. Asbestos fiber causes lung damage and leads to cancer.
Chemical Production Pesticides	28 2879	96 7	Dusts, organic acids, pesticide residues, chemical wastes	Metallic oxides, chlorinated hydrocarbons, organic-phosphorus compounds, inorganic and organic compounds	Metallic oxide dusts are toxic. Acids corrosive. Other wastes are flammable, poisonous, and spontaneously combustible.
Petroleum Refining and Related Industries	291 29	16 8	Caustic sludges, acid sludges, grease and oil residues, coke, wastes catalyst, filtering clays, asphalt and tars, chemicals, metals, asbestos	Tetraethyl lead, sulfonates, hydrocarbons	Toxic, carcinogenic, corrosive, damaging to lung tissues.
Leather Products	31	9	Scrap leather, dust, skin cleaning wastes, dyes, oils, and processing wastes	Metals and metallic compounds, volatile solids, Cr, H_2SO_4, lime	Irritants, toxicants, corrosive action on skin, possible carcinogens.
Primary Metal Manufacture	33	55	Pickle liquor, acid sludge, caustic wash, brine cleaners, slag, fly ash	Fe and Fe oxides, SiO_2, Al, Mg, lime, phenol cyanide, H_2SO_4, Cu, Zn, Cr, Ni, Pb	Inhalation of dusts extremely dangerous. Acids are corrosive.
Metal Fabrication	34,35 36,37	625	Metal scraps, acids and alkaline cleaners, pickling solutions, sludge, cyanides	Metallic oxides/dusts, Cr, Al, Fe, Cu, Sn, Zn, Ni, H_2SO_4, HCl, NaCN, KCN	Acids and cleaners are extremely corrosive. Metallic oxides toxic. Volatile cyanides dangerous if inhaled or ingested. Dust inhalation very dangerous.
Metal Finishing	3471	22			

[1]Compiled from: Goleuke and McGauhey, Comprehensive Studies of Solid Wastes Management, Second Annual Report, Table 25, pp. 94-98
State Department of Public Health, Hazardous Waste Disposal Survey 1971, Table 1, p. 16

Federal and State laws prohibit the indiscriminant discharge of chemical and industrial wastes to waters of the State and/or navigable waters of the United States. The Regional Water Quality Control Board established waste discharge requirements for all waste dischargers to these waters, which specify limitations on the discharge of pollutants to water resources.

The discharge of industrial pollutants to sanitary sewer is also regulated. The Federal Water Pollution Control Act (Sections 204(b), 307, and 308) requires the EPA to establish standards requiring pretreatment of wastes introduced into publicly-owned treatment works if those wastes would interfere with treatment operations. Most of the sanitary districts serving Alameda County have wastewater control regulations or ordinances in which strong industrial liquids and toxic chemicals are limited or prohibited. These discharge limitations vary from being written in general terms to containing specific wastewater requirements. Enforcement of these waste discharge controls requires

some industrial pre-treatment of liquid waste before discharge of liquid to the community sewer. Strong chemicals can upset and destroy biological processes (activated sludge treatment) at the sewage treatment plant in addition to being a health hazard to personnel. Some materials can pass through the system and show up in the plant effluent.

In order to uniformly control the quality of wastewater discharges to community sewers, the Alameda County Sewerage Advisory Committee, whose members represent the County's sanitary districts, and the California Water Pollution Control Association developed a Model Waste Water Ordinance which has been utilized by local sewerage agencies in revising their wastewater control ordinances.

The limitations on waste strength in the model ordinance are strict. The toxic or hazardous substances which are limited are arsenic, cadmium, copper, cyanide, lead, mercury, nickel, silver, chromium, and zinc, oil and grease, chlorinated hydrocarbons, and phenolic compounds. Such strict limitations will require greater source control measures such as chemical pre-treatment or recycling of liquid industrial wastes. The volume of liquid industrial wastes is likely to increase as more companies are required to treat their wastes and are not permitted to dump such materials into the community sewer.

Liquid Waste Collection, Transport, and Disposal by Vacuum Truck Haulers

There are presently eight registered sewage pumpers/haulers in the County. Ideally, these pumpers should dispose of their waste at Class I sites or to the sanitary sewer plant.[1] (Acceptance of this waste by the sanitary district is a prerequisite for sewer disposal.)

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[1] Opinion of Alameda County Acting-Chief Sanitarian, March, 1974.

At present, the pumpers are permitted to use the Richmond and Martinez Class I sites in Contra Costa County, the Turk Island site (which is designated as a Class II site), and the sanitary sewers. According to the County Acting Chief Sanitarian, sanitary districts are reluctant to accept these wastes which may contain hazardous chemicals (from chemical toilets) in addition to sewage material from septic tanks.

Covert dumping by "midnight haulers" of sewage pumpings is a real and serious problem. The inconvenient location of the Class I sites and the reluctance of local sanitary districts to accept sewage pumpings seem to encourage non-compliance with the County Environmental Health Agency's standards for disposal. Consequently, hazardous materials are indiscriminantly being dumped on land and in streams. As the sanitary districts' discharge limitations become more strict, an increasing reluctance to accept sewage pumpings is not unlikely.

Pesticides

"Pesticides" are economic poisons, and the term refers in general to all insecticides, fungicides, spray adjuvants, disinfectants, rodenticides, herbicides, plant growth regulators, and similar materials.[1] Pest control chemicals are categorized according to their degree of toxicity which is based upon its LD-50 rating. (The term LD-50 is translated as the lethal dose which will kill 50 percent of an animal test population and is expressed as oral or dermal.) Potential hazards associated with the use of any pesticide are dependent upon the characteristics of the chemical--its selectively, persistence, toxicity to animals, and effectiveness.

Because of their dangerous properties, certain pest control chemicals are designated as "restricted" materials, and a permit is required from the County Agricultural Commissioner for their possession and use. Injurious materials and restricted materials (defined in 3 CAC 2448, 2461, and 2461.1) are "permit" pesticides. Forty-nine pesticides or groups of pesticides in addition to pesticide treated seeds are designated as restricted materials. Restricted herbicides are primarily phenoxy herbicides such as 2.4-D.

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[1] California Department of Food and Agriculture, Laws and Regulations Study Guide for Agricultural Pest Control Advisor, Agricultural Pest Control Operator, Pesticide Dealer, Agricultural Pilot Examinations, page 5.

The quantity of pesticides used in Alameda County in 1973, based on County reports to the State, totalled 1,269,945.86 pounds.[1] This figure includes all materials applied by registered pest control operators and any restricted materials used by non-registered persons. In other words, restricted and non-restricted pesticides used by agricultural, residential, and structural pest control operators and by governmental agencies are included in the total figure. Restricted materials used by a non-registered person (i.e., rancher, etc.) are included, but the amount of non-restricted materials used by non-registered persons (i.e., homeowners, etc.) is not known and not included. The amount of pesticide used in the County is 0.69 percent of the total quantity used in California in 1973.[2]

Used Containers: Used pesticide containers are a health and safety threat to the community and the environment. Therefore, it has been made unlawful to dispose of any container which holds or has held pesticide material except in a manner which complies with the State Department of Food and Agriculture's rules and regulations (3 CAC 3135).

Pesticide containers may vary in size from 1 gallon or less to 55 gallon drums. Metal drums of the 55 gallon size and sometimes the 30 gallon size are usually returned to a distributor or drum reconditioner for reuse. Other containers are handled in Alameda County by:

(a) rinsing immediately after use with subsequent disposal at these Class II disposal sites in the County: Davis Street, Pleasanton Public Dump, and Turk Island Company sites.[3]

(b) leaving unrinsed with subsequent disposal at a Class I site in Contra Costa County, and

(c) burning the small, combustible containers in the field immediately after use under a BAAPCD permit.

State regulations (3 CAC 3141) require a triple rinse and drain procedure. Containers are rinsed and drained three times with a specific amount of water, and the rim in punctured to allow thorough draining. The Alameda County Department of Agriculture has established specific procedures to enforce State regulations on disposal of pesticide containers. Disposal occurs at specific sites under the supervision of the Department. Containers are inspected to insure

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[1] Alameda County Agricultural Commissioner's Office, April, 1974.

[2] Ibid.

[3] Acceptance of rinsed containers at these sites is pending policy (May, 1974) of the County Agricultural Commissioner.

proper decontamination. Non-compliance with the regulations will result in a Notice of Violation and possible cancellation of the user's registration and/or restricted materials permit.

The County issues permits for the purchase and use of restricted materials based on local conditions such as secondary pest problems; location of schools, homes, hospitals, bodies of water, and livestock; weather conditions; and bee activity. Anyone using restricted materials under a permit must complete a pesticide use report and submit it to the County Commissioner who reviews it to see that the pesticide was used properly. A copy of this report is sent to the State Department of Food and Agriculture. Pest control operators report on all types of pesticides used and must maintain records on each pest control operation. Permits are not required for non-agricultural uses of selected restricted materials. Certain pest control operations may be reported to the Commissioner on monthly summary forms.

Hospital and Medical Waste

In March, 1972, Alameda County had 1,731 establishments engaged in Medical and Other Health Services (Standard Industrial Classification Code 80), employing 20,182 persons.[1] These services include offices of physicians and surgeons, offices of dentists and dental surgeons, offices of chiropractors, hospitals, medical and dental laboratories, sanitariums, and convalescent and rest homes.

Wastes produced by medical services associated with human and animal care are considered hazardous because of their potential to produce disease or injury. Hospitals, clinics (both human and animal), laboratories, mortuaries, pharmacies, and physicians' and dentists' offices produce hazardous disposable wastes.

Hospital waste is composed of garbage, pathological and infectious wastes, general hospital waste, and drugs and chemical wastes. Included in these waste categories are the following hazardous materials: pathological and anatomic wastes; clinical laboratory wastes; animal remains; sharp materials such as needles, syringes and blades; contaminated patient wastes from isolation rooms; and liquid mercury spillage. Because specific hazardous materials may not be easily segregated from non-hazardous wastes at their point of origin, all of the waste material might be considered hazardous if little or no segregation of wastes occurs.

Waste Characteristics and Quantities: Waste accumulation in hospitals today is a major problem due to the increased use of single-use/disposable items. A recent estimate of hospital solid waste accumulated per patient is 34 pounds per day.[2] Highland Hospital produces 65 cubic yards of refuse

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[1] California Employment & Payrolls, page 85.

[2] Litsky, Martin, and Litsky, "Solid Waste: A Hospital Dilemma," (October, 1972), page 1842.

per week which is hauled to a landfill; Fairmont Hospital generates 35 cubic yards of solid waste which is disposed at a landfill site.[1]

Hospital wastes are disposed by three general methods: incineration, sewer, or hauling to a landfill. Food waste is generally ground up and carried away in the sanitary sewer system; some patient wastes enter the sewer. Most infectious wastes are not permitted to enter a community sewer, according to sanitary district regulations.

State laws and County policies determine which wastes are required to be incinerated. Infectious wastes are to be incinerated unless an alternate method is approved by the local health officer (17 CAC 134). Section 314 defines "infectious wastes" as including pathological and surgical (anatomic) wastes and materials from rooms of patients in isolation. BAAPCD has stringent requirements for incineration, and area hospitals have in the past been citied for incineration violations.[2] Presently, only pathological and surgical wastes and fetal remains are being incinerated, a small part of the total solid waste generated.

Solid hospital wastes are being hauled by a local scavenger company to two disposal sites in the County: Davis Street and Fremont (Durham Road).

CAN'T WE DO better THAN this?

The County Health Agency's recommended procedure for land disposal of medical wastes requires that infectious materials be containerized, sealed, and marked conspicuously. When specifically marked infectious materials are to be disposed of at a landfill, the hospital notifies the collection company which transports the material in a flatbed truck (no compacting or mixing with other refuse) directly to the site. The containers are buried in a hole before being covered with refuse and compacted. Other material from the hospital is treated as ordinary municipal refuse.

The Hospital Council of Northern California and the San Francisco Bay Area Health Association sponsored the Task Force on Medical Services Waste Disposal. The Task Force's purpose is to recommend uniform public policy concerning the handling and disposal of medical services wastes. Its "Guidelines for Handling and Disposal of Hazardous Wastes Associated with Medical Services" are being implemented by the County Health Department in local medical facilities and offices.

The preferred disposal system for hazardous medical waste is one which protects the personnel handling the material, the environment, and the community. Ideally, contaminated material should be sterilized or rendered innocuous as quickly as is possible.

[1] Personal Communication with Dr. W. Wilson Sampson, Alameda County Health Care Services Agency, Division of Environmental Health (February, 1974).

[2] Grant Cattaneo, Hospital Council of Northern California, memo, April 19, 1972.

Strict segregation of hazardous wastes at their point of origin hopefully will prevent contaminated material from being mixed with general refuse at a landfill site. Site personnel are notified when infectious materials in marked containers arrive for burial, but other hospital waste (which has been compacted) arrives unnoticed and unannounced. If careful segregation of waste has not occurred, then exposure to hazardous materials is inevitable. Disposing of contaminated waste and improperly destroyed sharps in a landfill site presents an environmental health hazard to the community.

TABLE II-8

TYPES OF WASTE PRODUCED BY HOSPITAL DEPARTMENTS[1]

SOURCE OF WASTE	TYPES OF WASTE MATERIALS																	
	DISPOSABLES														REUSABLES			
DEPARTMENT	Radiological	Pathological & Surgical	Small Animals	Sharps (Needles, Blades, Etc.)	Mixed Refuse Combustible	Segregated Non-Combustible	Food Waste Grindable	Food Waste Non-Grindable	Patient Care Items	Food Service	Linens	Garden Trash	Demolition Waste	Ash and Residue	Bottles	Patient Care Items	Food Service	Soiled Linen
Non-Medical Departments																		
Administration					nc													
Resident Facilities					nc													c
Engineering					nc								nc					
General Services					nc	nc						nc		nc	nc			
Laundry					c	c												c
Dietary					c	nc	c	nc		c							c	
Medical Departments																		
Clinical Services																		
Acute & Ext. Care		c		c	c	c	c		c	c	c				c	c	c	c
Obstetrics & Gyn.		c		c	c	c	c		c	c	c				c	c	c	c
Out-Patient	c	c		c	c	c			c		c				c			c
Pediatrics				c	c	c	c		c	c	c				c	c	c	c
Psychiatrics				c	c	c	c		c	c	c				c	c	c	c
Surgery		c		c	c	c					c				c			c
Support Services																		
Clinical Laboratory		c		c	c	c					c				c			c
Research Laboratory	c	c	c	c	c	c					c				c			c
Dental Clinic				c	c	c					c				c			c
Radiology					c	c					c							c
Pathology		c		c	c	c												
Pharmacy				c	c	c									c			c

Note: Above Designation of Wastes Indicates Departmental Locations Where Contaminated (c) and Non-Contaminated (nc) Wastes are Generated

[1] EPA; Solid Waste Handling and Disposal in Multistory Buildings and Hospitals, Volume 1, 1972

Radioactive Wastes

There are 56 commercial establishments in Alameda County which use radioactive materials. Radio-isotope materials are used primarily by hsopitals and medical facilities; these have a short half-life, lasting from one-half hour to 10-15 days. The short-life materials are being disposed in the sewers and in incinerators. The long-life radio-isotope wastes are collected by one company in the area who transports it by truck to a disposal site in Nevada. The Federal Department of Transportation monitors the trucks, and the Atomic Energy Commission regulates all handling and disposal procedures. Radioactive wastes from the Lawrence Livermore Laboratory in the City of Livermore are trucked to Nevada for disposal.

b. Wastewater Treatment Residues:

Sewage sludge is the "solid waste residue" resulting from the treatment of sewage in a wastewater treatment plant. Sludge is removed through settling at various stages in the treatment process; this material is "raw sludge" which is still about 95 percent water. Raw sludge is occasionally landfilled but is usually digested in digestion tanks at the treatment plant.

Digestion is the biological process of reducing organic matter present in raw sludge to a relatively stable condition. After digestion, the sludge still has a solids content of approximately five percent and may be pumped to a sludge settling pond or tank. After settling and evaporation, the concentrated sludge is usually dried or "dewatered" mechanically or by solar evaporation to a solids content of 20-25 percent before further handling. Dewatered digested sludge may be landfilled, incinerated, or used as a soil conditioner.

Alameda County residents, businesses, and industries are served by thirteen wastewater treatment plants with design capacities ranging from one-half million gallons per day to 120 million gallons per day. The County Planning Department staff conducted a telephone survey of these treatment plants in May, 1974, to determine the current amount of sewage treatment residues which contribute to the solid waste disposal problem in Alameda County.

There were wide differences in the per capita sewage sludge loadings from County treatment plants believed to result from differences in land use and treatment efficiencies. Two factors control the quantity of solids removed from sewage: (1) characteristics of the plant influent, and (2) the type and level of treatment. A large amount of solids residues is generated by canneries and residential communities. All of the municipal and district operated treatment plants provide some form of secondary sewage treatment with the exception of EBMUD, which is primary. Current solids residues are produced at a present (1975) rate of approximately 55 dry tons per day in Alameda County.

Table II-9 illustrates annual production of sludge solids by County sewerage agencies based on the May, 1974, survey.

TABLE II-9 ANNUAL SOLIDS PRODUCTION IN ALAMEDA COUNTY

Plant	Service Area	Annual Sludge Solids Produced (Dry Tons/Yr)
East Bay Municipal Utility District	Alameda, Albany, Berkeley, Emeryville, Oakland, Piedmont, Stege Sanitary District	9,125
San Leandro	San Leandro	1,179
Oro Loma	Castro Valley, Hayward, San Leandro	2,555
Hayward	Hayward	2,300
Union Sanitary District	Fremont, Newark, Union City	2,733
Valley Community Services District	Dublin, Pleasanton, San Ramon	1,471
Pleasanton	Pleasanton	69
Livermore	Livermore	653
TOTAL		20,085

what about a marketing study for sludge

Digested sewage sludge is considered a Group 2 waste if the moisture content is less than 75 percent and may be disposed in a Class II site, according to the State Water Resources Control Board, with much of it ending up in local landfills. Other methods of disposal are the use of dried solids as soil conditioner by local nurseries or incineration, but no incinerators are presently operating at treatment facilities in the County.

About 13.8 tons per day of digested sludge solids (dry) is used as soil conditioner by nurseries under contract with the City of Hayward and Union Sanitary District. East Bay Municipal Utility District is studying the effects of the application of sludge to crop land in Solano County, and the City of Livermore uses some of its solid residues as a soil conditioner in the city parks.

When EBMUD's secondary treatment facilities are on-line in 1976, their average solids production will increase to 58 dry tons per day, 21,000 dry tons per year. The other sewerage agencies do not, at present, anticipate large increases in sludge solids unless certain advanced treatment processes such as lime treatment are added to present design plans.

East Bay Municipal Utility District has studied several alternatives for handling their digested sewage sludge: dewatering, agricultural land application, ocean disposal, fertilizer production, incineration, and lagoons, with the two best alternatives, according to EBMUD's study, being agricultural land application and dewatering with subsequent solid waste disposal or utilization options. Their proposed sewage sludge management project consists of expanding the existing sewage sludge processing facilities and continuing the current practice of disposal at a landfill site until such time as a more attractive disposal or utilization option is developed. EBMUD plans to continue their study of applying sludge to agricultural lands. Another option which might develop in the future would be to dispose of the dewatered sludge in a pyrolysis facility such as the proposed East Bay Energy and Resource Recovery System.

c. Food Processing Residuals:

Food processing in Alameda County contributes a large amount of liquid and semi-solid waste, ranking Alameda County third in the State in 1968, in this category, behind Los Angeles and Santa Clara Counties. Food processing wastes accounted for more than 39 percent of the total estimated tons of industrial waste produced in the County in 1967. Food processing is a significant special waste problem because of the large proportion of waste produced relative to useful product.

In 1972, the County had 170 establishments in the Food & Kindred Products industry group (SICC 20), of which the most significant in terms of waste production are the meat products; canned, cured, and frozen foods; and miscellaneous and other foods and kindred products. The meat processing and dairy industries' waste products are largely reclaimed, and, therefore, do not present significant solid waste disposal problems. Fruit and vegetable processing, however, is accompanied by large quantities of solid and semi-solid waste products, much of which is organic and has a high moisture content, producing problems with on-site storage and disposal such as insects, rodents, odors, and leachate production in landfills. Some food processing materials can be converted into by-products and reused.

A survey (by the Alameda County Planning Department in February of 1974) of eighteen of the twenty-five food processors in the Department of Commerce Census of Manufacturers for 1967, engaged in canning and preserving fruits and vegetables, indicated that at least 78,206 tons of solid and semi-solid wastes and 1,900,500,000 gallons of wastewater are produced annually in Alameda County with the final destination

being land disposal sites. Food processing waste is composed of two basic types: mixed refuse, made up of a wide variety of materials, and organic waste, which contains water and food or product solids. It is the large quantity of organic waste from seasonal canning operations which presents special disposal problems.

Of the companies surveyed, the five largest operate eight processing plants which produce the bulk of the solid and liquid waste--98.7 percent of the solid (77,036.3 tons) and 97.5 percent of the liquid (1,852.8 million gallons)--from processing tomatoes, peaches, pears, figs, squash, prunes, beans, corn, cherries, and grapes. The eight plants produce 59,878 tons of organic waste per year.

Local scavenger companies dispose of food processing wastes generated by the eighteen plants with most of the seasonal cannery waste being hauled to three land disposal sites: two landfills (Richmond Sanitary Service and Newby Island) and one land-spreading and discing operation (Cooperative Environmental Improvement Company near Gilroy in Santa Clara County). In 1973, about 41,557 tons of organic canning waste was disposed outside of Alameda County. Ocean disposal of this wet waste is presently prohibited by the EPA. Non-seasonal organic wastes are either hauled to county landfills along with the mixed refuse or recycled. In addition to the organic wastes, dry paper and cardboard, peach pits, and metal cans are reported to be reused.

d. Junk Vehicles:

Description of the Problems Associated with Junk Autos

When a motor vehicle is no longer useful for transportation, it either becomes a special solid waste problem or a source of valuable materials. The junk vehicles become a waste problem when abandoned on public or private property or when accumulated in auto graveyards and wrecking yards. As a raw material resource, the vehicle provides automotive parts for the auto wrecking industry and scrap metal for the steel industry. Unfortunately, many junkers do not become converted into useful products and, therefore, create disposal problems.

Abandoned autos are primarily an aesthetic problem; hulks are highly visible, durable eyesores which adversely affect the appearance of urban neighborhoods, rural landscapes, and natural open space lands. Abatement of these wrecks by local governments is usually a costly and time-consuming process. Old wrecks tend to accumulate, forming automotive graveyards, thus compounding their visibility. Old vehicles are abandoned when legal disposition by the owner is difficult or because there is little economic incentive for the last owner to dispose of the car to an auto wrecker. Ignorance concerning proper disposal methods is also a factor.

The junk vehicle can be a source of useful products with the economic value of the vehicle depending upon age and condition. After the vehicle is stripped of saleable parts and most of the non-ferrous materials, the remaining hulk is transported to a scrap processor where the ferrous scrap is collected and processed into the forms and grades required by customers. Some whole vehicles are accepted by processors.

Magnitude of the Problem in Alameda County

Estimates of Junk Vehicles Generated: The actual number of junk vehicles generated and illegally abandoned in the County is unknown. One of the methods used to estimate automobile scrappage in a specified area is based on the following assumption:

> "The number of vehicles scrapped in a particular area will be positively correlated with the number of cars in the area."[1]

An equation was developed by Robert Louis Adams correlating State estimates of automobile and truck scrappage in 1968 with 1968 State vehicles registration data:

$$Y = -15.27476 + 0.094789\,(X)$$

where Y equals thousands of cars and trucks scrapped and X equals thousands of cars registered. Thus, if these 1968 co-efficients are assumed to still hold in 1974, the number of cars and trucks likely to be scrapped in Alameda County is 46,463 (based on 490,333 automobile registrations in the County in April, 1974).

Another report (by the Southern Pacific Transportation Company) estimates that 4,200 scrap automobiles are generated per year per 100,000 persons. Based on this generation figure and an estimated 1975 population for Alameda County of 1,142,000, Alameda County may produce 47,964 junk automobiles in 1975.

State and Local Regulation

The abandonment and disposition of junk vehicles is regulated by State law (Vehicle Code, Chapter 10, Parked and Abandoned Vehicles) and local ordinances. In short, it is illegal to abandon a vehicle on public property, highways, and private property (when the vehicle constitutes a hazard or a nuisance). Before the vehicle may be dismantled, the

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[1] For a detailed explanation of this method of estimation and the underlying assumptions, refer to Robert Louis Adams, An Economic Analysis of the Junk Automobile Problem, Bureau of Mines Circular 8596 (1973), pp. 118-123.

registered owner, the California Highway Patrol (CHP), and the State Department of Motor Vehicles must be notified. A wrecker or processor cannot legally accept a vehicle without obtaining the certificate of ownership, the registration card, and license plates at the time of acquisition from an individual; abandoned vehicles cannot be accpeted without an authorized "bill of sale." In Alameda County, the California Highway Patrol, the East Bay Regional Park District, the Alameda County Sheriff's Office, the County Building Inspection Division of the Public Works Agency, and the city police departments are involved with the abatement of abandoned vehicles.

e. Litter:

The State Solid Waste Management Board, in A Report on Litter Management in California, Conclusions and Recommendations, defines litter as ". . . any post-consumer solid waste which is not deposited in (1) an authorized solid waste disposal site, (2) appropriate storage containers, or (3) in other areas designated for disposal." Litter is, therefore, described as being primarily man-made waste which does not include such materials as leaves, dirt, and gravel, materials commonly found on urban streets.

Alameda County's Health and Safety Code defines litter as garbage, rubbish, and all other waste material which, if permitted to accumulate or if thrown or deposited upon streets, sidewalks, and private property, tends to create a danger to public health, safety, and welfare (§ 3-150.1; 3-150.2).

Government agencies involved in litter management in Alameda County are the State Division of Highways (Cal-Trans), the California Highway Patrol, the County Sheriff's Office, County Road Department, County Health Department, the East Bay Regional Park District, and public works agencies and police departments in the thirteen cities.

A telephone survey in March, 1975, of agencies in Alameda County who are involved in litter management activities showed that there is no existing comprehensive, County-wide program to combat the detrimental environmental health and safety impacts of litter. State, regional, County, and city agencies each operate a separate litter control program.

Litter control programs in Alameda County are generally associated with street and park maintenance activities, including special litter pickup crews to patrol roadsides and local recreation areas. Litter receptacles are placed in high activity areas such as parks, commercial areas, and schools. Local agencies will cooperate with citizen cleanup efforts by either providing refuse containers, crews, and/or equipment.

Litter is a problem in many areas of the County, even though a wide variety of litter control programs is being tested by government and citizen groups which are active in litter cleanup activities. The California Anti-Litter League with headquarters in Oakland provides

assistance and information to any agency or group and is continually educating the public on litter problems.

Enforcement of local ordinances and State litter laws is difficult because an eye-witness to the act of littering is usually necessary for successful prosecution. Some success has been reported in locating persons through written or material evidence (such as a letter or address label) and in requiring the violator to clean up the litter. State and local law enforcement agencies fail to maintain statistics on the number of citations issued for litter law infractions.

Information on the volume and composition of litter and on the costs associated with its control is imprecise and often lacking for several reasons:

- Litter pick up costs are often included in costs for street cleaning, and street cleaning costs are often hidden in total street maintenance costs.

- Information is not available on costs involved with attempts to apprehend or locate violators.

- Litter control often relies on voluntary efforts or the provision of "free" services. These hidden costs have not been quantified.

- There are no studies on composition of litter in Alameda County available.

- Available data on volumes of litter includes such materials as leaves, dirt, and trimmings; no specific data available on man-made litter.

4. Summary of Total Solid Waste Generation:

The quantities of municipal, agricultural, and industrial solid wastes produced in Alameda County in 1967 were estimated by the State Department of Public Health to have totalled to 1,860,000 tons per year, with municipal waste the major portion generated. As previously indicated, municipal waste generation will probably total 1,567,229.70 tons in 1975 (4,294 tons per day).

This estimate includes wastes which are landfilled in the County and wastes which are exported, illegally disposed, or reutilized. A 1973 estimate for Group 2 and Group 3 wastes being landfilled in the County is 1,048,000 tons based on 5 pounds per capita per day collected. Wastes which are exported from the County for disposal include seasonal cannery wastes (41,600 tons), sewage sludge from East Bay Municipal Utility District (21,900 net tons, average annual production, based on 60 net tons per day at 25 percent solids), and an unknown quantity of hazardous liquid industrial wastes which must be disposed in a Class I site if not reclaimed.

Table II-10 estimates the quantities of municipal solid wastes generated in 1973 and 1975. These estimates are derived from solid waste generation factors for Alameda County and population data. These factors are 5.00 pounds per capita per day for 1975, and include primarily Group 2 wastes.

TABLE II-10 ESTIMATED SOLID WASTE GENERATED FOR COLLECTION IN SELECTED CITIES, PLACES, AND PLANNING UNITS OF ALAMEDA COUNTY: 1973, 1975

Area	Estimated Population[1]		Quantity of Waste (tons/year)	
	1973	1975	1973	1975
CMPU	582,800	585,000	531,805	544,490
Berkeley	116,500	114,000	106,306	106,106
Alameda	76,100	79,500	69,441	73,995
Remainder CMPU	390,200	391,500	356,058	364,389
EPU	283,500	285,000	258,694	265,264
WPU	182,000	190,000	166,075	176,843
LAVPU	100,100	104,000	91,342	96,798
Pleasanton Area	31,400	32,600	28,653	30,342
Remainder LAVPU[2]	68,700	71,400	62,689	66,456
COUNTY TOTAL	1,148,400	1,164,000	1,047,915	1,083,393

[1] Alameda County Planning Department

[2] Note that a portion of San Ramon, Contra Costa County, in included in this data.

C. Elements of Existing Systems

In Alameda County, the existing solid waste management system consists of the following elements or functions: storage, collection, transport, processing for resource recovery of selected materials, and final disposal. Solid wastes are generated by households, businesses, and institutions and then stored in containers for collection by the scavenger service. The scavenger (private or municipal) transports the wastes by truck to a landfill site where some materials are salvaged with the remainder being buried. Some wastes never reach a landfill because they are separated out of the waste stream for salvage, ground into a slurry and transported through the sewers to a sewage treatment facility, or illegally disposed in rural areas. In general, however, most municipal wastes are buried in local landfills.

A discussion of the values of materials placed in Alameda County landfills and the potential for recovery from the waste stream is included in another section of this Plan.

The existing regulatory structure for solid waste management in Alameda County is complex due to (a) the number of agencies involved in controlling the flow of solid wastes, and (b) the wide variety of solid and semi-solid wastes generated and their potential environmental impacts.

1. Storage:

   Adequate storage of solid waste materials is the first step in handling solid wastes. Storage occurs on the premises where the waste is produced (homes, businesses, hospitals, etc.) and at locations where the wastes are waiting final reclamation (recycling centers, landfill sites, newsprint recovery facilities, etc.). The existing storage system requirements vary according to the characteristics and quantities of the waste materials. In general, solid wastes are stored in cans with lids (30-32 gallons), cubic yard containers (1 to 8 cubic yards), drop box containers (14 to 50 cubic yards), and compactor boxes (20 to 40 cubic yards) associated with compaction equipment, with the length of time stored variable. Highly putrescible wastes -- such as cannery residuals--are collected and removed daily from the source property. Demolition and construction materials are usually stored in an open container at the construction site until the container is full.

   Existing ordinances and contracts may or may not set standards for storage of solid wastes, and there is minimal regulation of garbage accumulation in the County Ordinance Code. The County Health and Sfaety Ordinance prohibits the accumulation of refuse and requires the health officer to approve the type of can. In addition, city and district ordinances may require that refuse shall not be stored so as to attract flys and rodents; all premises must have adequate can capacity; and the cans are to be water tight, have handles, be tightly covered, and be kept in a sanitary condition. Mandatory collection or refuse removal is required at least once every seven days by the County and most of the cities in order to prevent accumulations of refuse and the attendant health hazards.

   The primary health hazard associated with improper storage of wastes is the attraction of flies and rodents to the area. The rat problem in the Bay Area arises primarily from poor refuse storage and handling, according to the State Department of Health. The Norway Rat finds harborage in backyards and wherever materials accumulate. After 36 to 48 hours without food, it will move on to a more desirable habitat. Therefore, residential garbage cans need to be tightly covered, and illegal dumping of wastes in vacant lots must be discouraged. The County Health Department sanitarians respond to complaints on the improper storage of wastes in order to protect the public health.

These complaints frequently concern overflowing cans and containers, unsightly accumulations of rubbish in residential neighborhoods, and rodent and insect infestations caused by improperly contained refuse. The Health Department is presently conducting a study on waste storage problems in selected areas of Oakland. Results of this inquiry will become a part of the waste management information system.

2. Collection:

The most costly element of existing solid waste management is the collection of solid wastes.[1] Information was obtained from each city or special district and the collection company or agency operating within each area; the organization, operation, and revenues generated for each of the sixteen collection operations within the four disposal service areas (or County planning units) was examined.

Refuse collection in Alameda County is provided by two municipal collection systems, two small private collectors, and one large private collection company. The cities of Berkeley and San Leandro operate their own collection service, and the cities of Alameda and Pleasanton engage individual private contractors to collect their refuse. The remainder of the County is serviced by the Oakland Scavenger Company through exclusive contracts with each jurisdiction.

The Oakland Scavenger Company is, by far, the largest refuse collection organization operating in Alameda County. Oakland Scavenger serves 9 of the 13 cities and all of the developed unincorporated areas of the County.

Central Metropolitan Planning Unit (CMPU)/Disposal Service Area

The CMPU is an older established area showing only slight population increases each year. In 1975, the estimated population of the CMPU was estimated at 576,000. All of the CMPU is incorporated and it is composed of the cities of Alameda, Albany, Berkeley, Emeryville, Oakland, and Piedmont. The topography is nearly flat in the western two-thirds; the Berkeley and Oakland Hills rise in the eastern one-third. Total land area of the CMPU is about 80 square miles.

Refuse collection in the City of Alameda is provided by a small private corporation, the Alameda City Disposal Company, operation under a 10-year exclusive franchise (1972-1982). The City of Berkeley owns and operates its collection system (Refuse Collection Division in the Public Works Department). Collected refuse is taken to the Berkeley landfill.

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[1]A background report on residential and commercial collection systems prepared for the SWMPAC and SWMPTAC in November, 1974.

TABLE II-11

CENTRAL METROPOLITAN PLANNING UNIT
DISPOSAL SERVICE AREA

ALAMEDA CITY DISPOSAL COMPANY
MUNICIPAL REFUSE COLLECTION STATISTICS

Accounts:	
Residential-Commercial Drop Box	20,000
Number of Routes:	
Residential	9
Front-End Loader	0
Drop Box	3
Statistics (one week)	
Miles	2,935
Loads	175
Tonnage	500

SOURCE: Personal correspondence with Jerry Eichelberger, Administrative Services Supervisor, City of Alameda (June 25, 1975).

TABLE II-12

CENTRAL METROPOLITAN PLANNING UNIT
DISPOSAL SERVICE AREA

CITY OF BERKELEY
MUNICIPAL REFUSE COLLECTION STATISTICS

Accounts:	
Residential-Commercial	24,480
Front-End Loader	1,235
Total Accounts	25,715
Number of Routes:	
Residential	16
Front-End Loader	3
Statistics (One Week):	
Miles	3,038
Loads	66
Tonnage	730

SOURCE: Personal correspondence with Richard Gazlay, Assistant Director of Public Works, City of Berkeley (May 28, 1975). One week statistics derived from annual figures for FY 1973-1974.

TABLE II-13

CENTRAL METROPOLITAN PLANNING UNIT
DISPOSAL SERVICE AREA

OAKLAND SCAVENGER COMPANY
MUNICIPAL REFUSE COLLECTION STATISTICS

	Albany	Emeryville	Oakland	Piedmont
ACCOUNTS:				
1-3 Residential Units	4,233	376	78,017	3,764
4+ Residential Units	414	134	13,517	64
Commercial	170	88	7,816	39
Subtotal	4,817	598	99,350	3,867
Front-End Loader	0	0	1,505	0
Total Accounts	4,817	598	100,855	3,867
NUMBER OF ROUTES:				
Residential	2	2	53	2.5
Front-End Loader	0	0	4	0
STATISTICS (One Week):				
Miles	643	NA*	13,723	359
Loads	16	NA	552	13
Tonnage	75	NA	2,595	61.5

*Not Available.

SOURCE: Oakland Scavenger Company, Preliminary Draft, Collection Element, Solid Waste Management Report, "Summary of June, 1974, One Week Route Survey" (August 28, 1974).

The Cities of Albany, Emeryville, Oakland, and Piedmont have granted exclusive collection service contracts to the Oakland Scavenger Company. Municipal refuse from those cities is being hauled to the Davis Street disposal site in San Leandro. Table II-13 illustrates information on accounts, routes, and service statistics supplied by the Oakland Scavenger Company. Residential collection is from the backyard.

Eden Planning Unit (EPU)/Disposal Service Area

The Eden Planning Unit is composed of the Cities of Hayward and San Leandro, the Oro Loma Sanitary District, and the Castro Valley Sanitary District. Total population for the planning unit was estimated at 276,100 persons on January 1, 1975.

Refuse collection service in the Eden Planning Unit is accomplished by both municipal and private collectors. The City of San Leandro provides residential and commercial service for part of the City with industrial collection handled by a private collector under contract to the City. The rest of the planning unit receives collection service from the Oakland Scavenger Company.

The Oro Loma Sanitary District, the Castro Valley Sanitary District, and the City of Hayward have granted exclusive (franchise) contracts to the Oakland Scavenger Company for residential, commercial, and industrial collection services. (Oro Loma serves residents in the unincorporated communities of Ashland and San Lorenzo together with a portion of the cities of San Leandro and Hayward. The Castro Valley Sanitary District serves the unincorporated areas adjacent to, and easterly of Oro Loma.) In all of these communities, subscription to the refuse service is mandatory.

TABLE II-14

EDEN PLANNING UNIT
DISPOSAL SERVICE AREA

OAKLAND SCAVENGER COMPANY
MUNICIPAL REFUSE COLLECTION STATISTICS

	Oro Loma Sanitary District	Castro Valley Sanitary District	Hayward
ACCOUNTS:			
1-3 Residential Units	23,646	10,975	19,708
4+ Residential Units	3,067	571	2,082
Commercial	1,194	1,002	2,094
Subtotal	27,907	12,548	23,884
Front-End Loader	746	644	1,236
Total Accounts	28,653	13,192	25,120
NUMBER OF ROUTES:			
Residential	12	9	11
Front-End Loader	7	1.5	4.5
STATISTICS (One Week):			
Miles	3,047	1,918	2,950
Loads	135.5	66	138
Tonnage	645	313	652

SOURCE: Oakland Scavenger Company, Preliminary Draft, Collection Element, Solid Waste Management Report, "Summary of June, 1974, One Week Route Survey" (August 28, 1974)

Oakland Scavenger provides backyard pick up (within 150 feet of the curb) for residential areas in all of its service areas.

The City of Leandro's refuse residential and commercial collection service is operated by the Department of Public Works. Approximately 47,700 persons are served by the municipal collection service. Part of San Leandro is located in the Oro Loma Sanitary District; this area is under contract to the Oakland Scavenger Company and, therefore, is not in the San Leandro collection system. Industrial rubbish and refuse collection is franchised out to a private collector, S & R Pick Up Service.

The City has a contract with the S & R Pick Up Service for the collection of some rubbish and refuse in the commercial and industrial districts in the City. The contract which expires on February 28, 1979, establishes collection rates for non-compacted rubbish and refuse and for specially processed or specially compacted materials. The City of San Leandro disposes its refuse to the Davis Street site.

TABLE II-15

EDEN PLANNING UNIT
DISPOSAL SERVICE AREA

CITY OF SAN LEANDRO
MUNICIPAL REFUSE COLLECTION STATISTICS

ACCOUNTS:	
Residential-Commercial	12,264
Front-End Loader - Drop Box	275
Total Accounts	12,539
NUMBER OF ROUTES:	
Residential	8
Front-End Loader	2
Drop Box	2
STATISTICS (One Week):	
Miles	1,212.6
Loads	77.3
Tonnage	339.7

SOURCE: Personal communication with Robert Lawrence, Refuse Service Supervisor, City of San Leandro (May 27, 1975). One week statistics developed from monthly summaries: January, 1975, to April, 1975.

Washington Planning Unit (WPU)/Disposal Service Area

The Washington Planning Unit includes the Cities of Fremont, Newark, Union City, and the adjacent unincorporated areas. The planning unit had an estimated 1975 total population of 181,845. It encompasses an area of 124 square miles of land, 93 percent of which is incorporated. Refuse is hauled to the Fremont landfill site at the foot of Durham Road.

TABLE II-16

WASHINGTON PLANNING UNIT
DISPOSAL SERVICE AREA

OAKLAND SCAVENGER COMPANY
MUNICIPAL REFUSE COLLECTION STATISTICS

	Fremont	Newark	Union City
ACCOUNTS:			
1-3 Residential Units	23,873	6,597	6,356
4+ Residential Units	646	345	64
Commercial	1,497	350	255
Subtotal	26,016	7,292	6,675
Front-End Loader	1,160	163	189
Total Accounts	27,176	7,455	6,864
NUMBER OF ROUTES:			
Residential	12	3	4
Front-End Loader	5	1	1
STATISTICS (One Week):			
Miles	3,416	831	761
Loads	167	35.5	26.5
Tonnage	794	168	125

SOURCE: Oakland Scavenger Company, Preliminary Draft, Collection Element, Solid Waste Management Report, "Summary of June, 1974, One Week Route Survey" (August 28, 1974).

Livermore-Amador Valley Planning Unit (LAVPU)/Disposal Service Area

In the eastern portion of Alameda County, the Livermore-Amador Valley population was estimated to be 106,400 in January, 1975, and is concentrated in the cities of Livermore and Pleasanton and the unincorporated community of Dublin, with an urbanized area of about 96 square miles.

A subsidiary of the Oakland Scavenger Company, the Livermore-Dublin Disposal Service provides collection services to the City of Livermore and the Valley Community Services District. The City of Pleasanton has contracted with the Pleasanton Garbage Service, Inc., for refuse collection.

Refuse is to be disposed in the Vasco Road site after closure of the Pleasanton Public Dump, and the Pleasanton Garbage Service is building a transfer station in the city.

In the City of Livermore, all premises are required to have adequate storage capacity for any refuse that normally accumulates between pick ups; refuse is not to be allowed to accumulate. The Valley Community Services District (which provides solid waste collection services to the unincorporated community of Dublin and portions of San Ramon in Contra Costa County) requires subscription to the collection service provided by the Livermore-Dublin Disposal Service. Collected refuse in the two jurisdictions is hauled to the Vasco Road (Eastern Alameda County) disposal site.

TABLE II-17

LIVERMORE-AMADOR VALLEY PLANNING UNIT
DISPOSAL SERVICE AREA

PLEASANTON GARBAGE SERVICE
MUNICIPAL REFUSE COLLECTION STATISTICS

	Pleasanton
ACCOUNTS:	
Residential-Commercial	7,300
Front-End Loader	225
Drop Box	20
Total Accounts	7,545
NUMBER OF ROUTES:	
Residential	4
Front-End Loader	1
Drop Box	1
STATISTICS (One Week):	
Miles	NA*
Loads	75
Tonnage	70

*Not Available

SOURCE: Personal correspondence with Robert Molinaro, Owner, Pleasanton Garbage Service, Inc. (May 19, 1975)

TABLE II-18

LIVERMORE-AMADOR VALLEY PLANNING UNIT
DISPOSAL SERVICE AREA

OAKLAND SCAVENGER COMPANY
MUNICIPAL REFUSE COLLECTION STATISTICS

	Valley Community Services District	Livermore
ACCOUNTS:		
1-3 Residential Units	6,614	12,037
4+ Residential Units	0	42
Commercial	239	397
Subtotal	6,853	12,476
Front-End Loader	239	387
Total Accounts	7,092	12,863
NUMBER OF ROUTES:		
Residential	4	8
Front-End Loader	1	2
STATISTICS (One Week):		
Miles	2,500	2,184
Loads	39.5	85
Tonnage	186	402

SOURCE: Oakland Scavenger Company, Preliminary Draft, Collection Element, Solid Waste Management Report, "Summary of June, 1974, One Week Route Survey" (August 28, 1974).

TABLE II-19

SELECTED RESIDENTIAL AND COMMERCIAL REFUSE COLLECTION SERVICE CHARGES

ALAMEDA COUNTY, NOVEMBER, 1974

Jurisdiction		Size of Can (Gallons)	Monthly Rate One Can-Two Cans One Pick Up/Wk		Rate Per Cubic Yard Per Pick Up	Monthly Rate (Yardage Chg.) One Cubic Yard One Pick Up/Wk (From 1 Cu. Yd. Container)
CMPU:	Alameda	30	$2.70	$4.95	$2.70	*
	Albany	30	1.90	3.80	1.70	*
	Berkeley	32	2.55-2.85	4.75-5.05	NA	$11.15
	Emeryville	30	1.90	2.20	1.70	*
	Oakland	32	2.40	4.00	2.25	*
	Piedmont	30	1.90	2.20	1.90	*
EPU:	Castro Valley S. D.	32	2.90	4.80	2.85	*
	Hayward	32	2.90	4.80	2.85	*
	Oro Loma S. D.	32	2.50	4.00	2.50	*
	San Leandro	32	2.40	4.00	2.40-3.90	11.65
WPU:	Fremont	30	2.60	4.15	2.10-2.50	9.50
	Newark	30	2.60	4.15	2.10-2.50	9.50
	Union City	30	2.60	4.15	2.10-2.50	9.50
LAVPU:	Livermore	30	2.35	3.40	1.80	*
	Pleasanton	30	2.45	3.90	2.75	11.00
	VCSD	32	2.20	3.70	2.10	*

*Rate not calculated in this manner in the rate schedule for the jurisdiction.

3. Transport:

The existing refuse transport system is based on the collection truck: rear loader and side loader packer trucks, front-end loaders, and drop box "piggyback" vehicles. Refuse is hauled in these trucks directly to the landfill site. One transfer station has been approved for operation in Pleasanton; another is proposed in Berkeley; and Oakland Scavenger Company has mentioned opening several to serve their collection system throughout the County.

The transportation of solid wastes on public streets is regulated in local ordinances. Regulations pertain to truck body design, covers, and truck maintenance and sanitation. In general, solid wastes are not to be exposed while in transit or to spill or leak out. Some jurisdictions require the issuance of a permit in order to transport solid wastes.

Alameda, Berkeley, Fremont, and San Leandro have disposal sites within their city limits which accept the cities' household garbage and rubbish. Collection service trucks in other jurisdictions must travel several miles to a site. Table II-20 gives an estimate of the miles traveled to the disposal site from the approximate center of the jurisdiction.

TABLE II-20

APPROXIMATE DISTANCE FROM DISPOSAL SERVICE AREA TO DISPOSAL SITE, ALAMEDA COUNTY, 1975

Disposal Service Area	Site	Distance (Miles)
Alameda	Alameda (City)	3
Albany	Davis Street	18
Berkeley	Berkeley	3
Emeryville	Davis Street	13
Oakland	Davis Street	9
Piedmont	Davis Street	12
San Leandro	Davis Street	3
Castro Valley	Davis Street	8
Oro Loma	Davis Street	6
Hayward	Davis Street	10
Union City	Fremont	10
Newark	Fremont	7
Fremont	Fremont	4
Pleasanton	Pleasanton	3
Livermore	Eastern Alameda Co.	6
Dublin	Eastern Alameda Co.	18

4. Processing and Resource Recovery:

While there is at present no solid waste processing of municipal refuse on a large, County-wide scale to recover useable materials or energy, some resource recovery is being accomplished by community recycling centers, the Oakland ScavengerCompany and other local collection companies, Schnitzer Steel Products, local steel mills, Kaiser Aluminum and other local aluminum can and beer companies, and County industries and businesses who separate out reuseables from their wastes or who use recovered materials in manufacturing.

a. Community Recycling Centers:

Community recycling centers in Alameda County are continually opening and closing as marketing, seasonal, and individual conditions change. Today, there are 20 to 25 operating recycling centers in Alameda County; and they are unique with respect to organization, facilities, staffing, services provided, materials collected, cash flow, and operational problems. Increased citizen and business interest in recycling has combined with more favorable markets for secondary materials to encourage an expanding number of recycling centers.

The Community Solid Waste Reduction and Recycling Program (CSWRRP)is the largest center in the County in terms of total tonnage recycled (about 222.6 tons monthly in 1972-73) and highest per capita pounds recycled (about 46 pounds per Berkeley resident in FY 1972-73). The program operates at three locations in the city. Materials recovered are aluminum, newsprint, carboard, brown paper bags, steel-tin, bi-metal, and sorted glass.

Another recycling organization operating in the County is the Pacific Recycling and Environmental Education Project (PREEP). It operates at a level between the recycling site and the secondary materials brokers by providing capital, containers, trucking, and accounting services to several sites. By serving several small sites, some economies of scale are achieved. The estimated average monthly volume of materials handled by PREEP (July, 1974) was 53.5 to 60.5 tons.

The Eden Area YMCA operates a center at the Co-op in Castro Valley and one at the YMCA's headquarters in Hayward. The estimated monthly quantity of recycleables was 23-30 tons (May, 1974).

The San Leandro Ecology Center provides a collection service for recycleables, and the center's truck travels one route each day in San Leandro. The majority of the materials is collected from fifty apartment buildings, and the estimated monthly quantity of recycleables was 24-33 tons (July, 1974).

The Mount Eden Recycling Center collects about 8.25 tons monthly (June, 1974) of various materials including office paper.

Kaiser Aluminum's Can-Do program includes a facility to accept aluminum beverage containers which is located in Union City. The volume of aluminum recycled by the station is estimated by Kaiser to be $8.7^{\pm}$ tons per month and is steadily climbing. The Can-Do facility is an example of a place where the general public can receive money for aluminum cans.

The Livermore Recycling Center schedules non-profit groups to perform the physical labor and earn $70 for their weekend's efforts. The center is recycling approximately 2.5 pounds of materials every month for each person in the city; estimated average monthly volume (June, 1974) was 59.3 tons. In addition, the center has accomplished some innovative environmental education programs which include public speakers, telephone and patron surveys, bumper stickers, and notices in local food stores which advise consumers of the environmental impact of certain types of packaging.

The Livermore Paper Project recycles an average of 40 tons per month of newsprint. The Dublin Recycling Center uses local non-profit groups to staff the center each weekend and collects about eight tons of materials monthly, mostly newsprint. Also, approximately twenty to twenty-five boy scout troops in Alameda County have organized newspaper drives in the recent past.

These centers are examples of the kinds of recycling centers operating in the County. In addition to removing useable materials from the waste stream, the centers provide information to the general public on environmental and resource recovery issues and conservation techniques.

b. Oakland Scavenger Company:

The Oakland Scavenger Company is presently engaged in two materials recovery activities: tin cans and paper stock. In the past, the Company operated a hog ranch, a bottle yard, and a waste rag salvage unit. When these operations became unprofitable, they were discontinued.

Tin cans are being recovered from municipal wastes at the Company's Davis Street disposal site in San Leandro. The scrap steel/tin cans are magnetically removed by a shredder which is operated by the Los Angeles By-Products Company. L. A. By-Products uses the cans as "precipitation iron" to leach copper from its low-grade ore. The present shredder can recover 20 to 25 tons per day at maximum operation. The shredder does not operate daily, however, due to mechanical problems or adverse weather conditions. L. A. By-Products is implementing a new shredder with greater capacity and operational effectiveness.

A subsidiary company, Bay City Paper Stock Company, processes newsprint and corrugated fiber. Annual production totals to 35,000 tons of paper stock. Approximately 25 percent of the waste paper received is newsprint and 75 percent is corrugated fiber.

c. Junk Vehicles and the Secondary Materials Industry:

There are two major steel products companies in Alameda County who regularly process junk autos and auto bodies (with other steel companies accepting hulks on an irregular basis). Schnitzer Steel Products of California is located in Oakland, and Pacific States Steel Corporation is located in Union City.

Schnitzer Steel Products of California is the largest scrap metal processor and supplier on the West Coast. Its 50-acre plant in Oakland has a $1.5 million hammer mill shredder capable of processing 2,000 junk autos per day, based on two 8-hour shifts per day.

Scrap is processed for both foreign and domestic sales. Schnitzer processes both stripped (hulks) and unstripped auto bodies at the present average of 500 cars per day, based on one 8-hour shift. About twenty-seven percent of an unstripped car is waste material. This waste (non-metals) is presently being disposed in a landfill site (Richmond, Contra Costa County) where it is used as topsoil cover.

According to Schnitzer, the market value per ton of scrap steel on April 30, 1975, is as follows:

Auto Bodies	$50
#1 Prepared Steel	$75 - 85
#2 Prepared Steel	$70 - 75
Unprepared Steel	$50
Motor Blocks	$50

Price for auto bodies average $50/ton but may go as high as $60 for junkers from longer distances to help defray the truck transportation costs of the supplier. Motor blocks are often left attached to the vehicle rather than being removed for sale separately.

Pacific States Steel Corporation processes autos for use in its own steel mills. Junker hulks are processed using the baling method - autos are pounded into cubes, with 160-205 tons processed per 8-hour shifts. Pacific States usually operates three shifts daily.

According to Pacific States Steel, the following proces were paid per ton of scrap steel on April 30, 1975:

Auto Hulks	$40
#1 Prepared Steel	$60
#2 Prepared Steel	$50
Motor Blocks	$50
Turnings	$30

Both Schnitzer and Pacific States Steel receive junkers from not only Alameda County, but also from other counties in California and, during periods of high demand, from out-of-state.

5. Disposal:

Four methods of solid waste disposal are presently being used in Alameda County: incineration, grinding with transport through the sewers, specialized land application, and landfill. The landfill technique is the major method being used in the County.

Incineration of solid wastes is not being practiced on a large scale by industry and institutions in the Bay Area primarily because of the Bay Area Air Pollution Control District's regulation for the control of smoke and particulates. Hazardous medical wastes--pathological and surgical wastes--along with dead animals from local humane societies are being incinerated in order to protect the public health. Open burning of agricultural wastes is practiced on special days designated by the BAAPCD.

Specialized land application includes the techniques of spreading, discing, and composting. Composting involves the processing of organic wastes to form a humus-like soil conditioner. Discing is a form of composting which involves periodically turning the top few inches of soil after spreading the semi-solid or liquid waste on the land. Composting of dewatered, digested sewage sludge is being practiced by some local sewerage agencies. Cannery wastes are being spread and then disced into the soil on farmland in Santa Clara County. Hazardous industrial wastes are being hauled to Contra Costa County for disposal in Class I sites by ponding with evaporation and infiltration, soil mixing, and blending with other wastes.

Landfill Disposal:

Alameda County relies on landfill disposal for almost all of its residential, commercial, and industrial solid wastes. There are eleven waste disposal sites in the County, and these have accepted most of the Group 2 and Group 3 wastes generated by the County residents and businesses. Group 2 wastes may be defined as chemically or biologically decomposable materials. Examples include: garbage, rubbish, wood and metal demolition debris, dead animals, sewage treatment residues, tires, and rubber scrap. Group 3 wastes consist entirely of non-water soluble, decomposable inert solids, such as concrete, asphalt, brick, glass, and plastics. Alameda County's Class II-2 sites are "modified landfill" sites, as they do not meet all the requirements for classification as sanitary landfills. A "sanitary landfill" may be defined as being a landfill which is engineered to provide safe, efficient disposal of waste by spreading the refuse in thin layers, compacting the refuse to the smallest practicle volume, covering the refuse daily with a soil cover of at least six inches, and applying such cover at the end of each working day over all of the uncovered area. In general, operators of County landfill sites are not covering the face of the refuse at the end of the day.

All of the disposal sites, excluding Alameda Naval Air Station, are operated by private firms. Six of the landfills are owned by the operator with the remainder owned by public entities. Two of the sites are due to be closed by 1976. Only two of the sites have any long-term capacity (25 years or more) at their present rate of fill.

The sites are concentrated along the western edge of the County; nine disposal sites are located within, or adjacent to, the San Francisco Bay. Two of the sites are located in agricultural areas in the eastern part of Alameda County.

The following is a brief description of the County's landfill sites with a full discussion of site operations and activities, environmental problems, and future design plans contained in the Appendix to the Plan.

The Albany Landfill, now closed, is located west of Golden Gate Fields near Albany Hill. The disposal site is a fill reclamation project in the City of Albany's tidelands grant area of approximately thirty acres of a proposed total island area of approximately one hundred and five acres and has been reclaimed to date. Materials formerly accepted for disposal were primarily Group 3 wastes. A private company, Albany Landfill Corporation, operated the site under close supervision by the City and had been in operation since 1964. It had been receiving about eighty thousand tons of refuse and rubbish annual prior to its closing. The Albany City Council voted in March, 1975, for a temporary cessation of fill operations until a modification of the original plan is approved and the necessary permits are obtained. Group 3 materials are being accepted for cover, but all dry rubbish such as street sweepings are being disposed at the Berkeley Landfill. Completion date of the project is unknown.

The Berkeley Landfill is a 40-acre bay fill located about one mile west of the Eastshore Freeway between the westerly extensions of Page and Gilman Streets in the City of Berkeley. It accepts municipal wastes collected in the City of Berkeley and household wastes from individual residents in Emeryville, Oakland, Albany, and El Cerrito. Approximately three hundred and seventy-five tons per day is disposed and remaining capacity is estimated at six years.

The City of Berkeley owns the disposal site which has been maintained and operated by the Berkeley Landfill Company since 1969. The present filling operation began in October, 1968. Land use in adjacent areas is primarily recreational (Berkeley Yacht Harbor and Golden Gate Fields Racetrack). In addition, land within 3,000 feet of the disposal area is used for residence, business, industry, and transportation.

The site has been classified as a Class II-2 disposal area by the Regional Water Quality Control Board. It is a modified landfill with cover applied weekly on active areas averaging 100 feet by 200 feet.

Inspections of the site are conducted by the Bay Area Air Pollution Control District and the San Francisco Bay Regional Water Quality Control Board. The City of Berkeley's Health, Fire, and Public Works Departments maintain supervision over the disposal operations. The Public Works Department uses aerial photogrammetry to maintain records of the filling process. The Health Department does not regularly inspect the site but does respond to complaints in addition to maintaining control over the vector of the population.

The Alameda Naval Air Station solid waste disposal site is located at the south-western corner of the Station on less than 100 acres, adjacent to the San Francisco Bay. The site serves the entire Naval Air Station complex, except the military housing. (Household refuse is hauled to the Davis Street site.) The landfill operation began in 1958 and is expected to remain in operation for eight more years. The estimated remaining capacity, as of November, 1974, is 370 acre feet. The rate of filling averages 160 tons per working day, or 40,000 tons annually.

The NAS Alameda site is not inspected by the County Health Department or any local agencies because it is a federal installation and not under local jurisdictions. The RWQCB has not adopted waste discharge requirements for the site. Site operations are managed by naval personnel.

The Alameda City Disposal Class II-2 site began operation in 1953 on Doolittle Drive at the north end of Bay Farm Island adjacent to the San Leandro Channel in the City of Alameda. The operation is long overdue for closing but will remain in use until a suitable alternative for the disposal of the city's refuse is found. The 29-acre site is accepting garbage, rubbish, demolition and construction wastes, metals, and tires at the rate of 110 tons per day. The city's contract with the operator (Alameda City Disposal Company) limits use of the site to residents and businesses of the Ctiy of Alameda, and it stipulates that the municipal garbage disposal ground is to be located within the city or within ten miles of the city limits. No waste discharge requirements were prescribed by the RWQCB. The site is periodically inspected by the County Health Department and the City of Alameda.

The Davis Street disposal site is located at the west end of Davis Street in the City of San Leandro. The site is owned and operated by the Oakland Scavenger Company and was placed in operation in 1942 when the area was diked off from the Bay. Thus, a bay fill on approximately 220 acres has occurred on this site for nearly 33 years. The site's service area includes the cities of Albany, Emeryville, Oakland, Piedmont, San Leandro, Hayward, and Oro Loma and Castro Valley Sanitary Districts, with an estimated total population in 1975 of 663,000 persons.

The disposal operation will be completed in late 1976, and the operator/owner has talked about the establishment of a transfer station and processing facility on the site.

Inspection of the disposal operation is performed by the Bay Area Air Pollution Control District, Regional Water Quality Control Board, and the Alameda County Health Care Services Agency. The City of San Leandro does not regularly inspect the site, but may inspect it to determine compliance with the use permit. The City receives the weekly and monthly reports of the County Health Department's inspections.

The San Leandro Marina disposal site is located at Neptune and Fairway Drive, south of the San Leandro Marina. The site is owned by the City of San Leandro and is operated by Turk Island Company. Group 2 and Group 3 wastes are received from the communities of San Lorenzo, Oakland, San Leandro, and Castro Valley at the rate of 100 tons daily. Total area in the site is 140 acres with 135 acres being used for refuse fill. Located adjacent to the San Francisco Bay, the Marina disposal site is surrounded by commercial, residential, and recreational development.

The waste is covered once every one to two weeks, as little putrescible material is received, and most of the rubbish is Group 3 waste. Maximum depth of the final fill is approximately 22 feet. The site is due to be completed in 1976, with a golf course planned for its ultimate use.

The West Winton disposal site is owned and operated by a division of the Oakland Scavenger Company (Bay Cities Disposal), and it is located at the west end of Winton Avenue in the unincorporated area near Hayward and adjacent to the San Francisco Bay. Total site area is 525 acres with the most recent operation having occured on a 59-acre parcel. Disposal operations in the area began on the south side of Winton Avenue in 1951. The recent operation began in 1970, and it was completed in 1974. The site is zoned for Heavy Industrial use, and adjacent land uses are marsh and tidelands and the Hayward sewage treatment plant's oxidation ponds.

The company plans to operate an interim transfer station for the South County area after final cover is applied.

The Regional Water Quality Control Board classified the site as Class II-2, and it was accepting 450 tons of Group 2 wastes daily from the communities of Castro Valley, Hayward, part of San Leandro, and the unincorporated area. Hazardous medical wastes were being received at the site.

The Turk Island landfill is located in Union City on Union City Boulevard. The 122-acre site, of which 73 acres is used for landfill, has been owned and operated by the Turk Island Company since 1962 under a Union City use permit. The northern boundary is adjacent to the Alameda County Flood Control and Water Conservation District Flood Canal. Land uses in the surrounding area include salt ponds, agriculture, and developing residential. Rubbish from residential, commercial, and industrial sources in Union City, Fremont, Hayward, Newark, and the

unincorporated areas is accepted for disposal. Remaining capacity of this low-lying flood plain site is estimated at 8 years (until 1982) at the rate of 15,000 tons disposed per year. Daily tonnage totals approximately thirty tons of Group 2 and Group 3 wastes.

The Turk Island Company landfill site is inspected by the Alameda County Health Care Services Agency, Regional Water Quality Control Board, and the Bay Area Air Pollution Control District. The County Health Department inspects the site weekly. BAAPCD is responsive to complaints but does not maintain a regular schedule of inspection. The RWQCB requires the operator to maintain a self-monitoring program and inspects the site irregularly. In addition, the City of Union City is supposed to regulate disposal operations according to Ordinance No. 32.1-64, Section 4.04 Dump Operation Regulations.

The Durham Road disposal site, also known as the Fremont site, is located in the City of Fremont at the west end of Durham Road and approximately one-quarter mile southeast of Mowry Slough. Because of the agreement between the cities of Fremont, Newark, and Union City and the scavenger company, this site can only accept refuse from this area. Operated by the East Bay Disposal Company (a subsidiary of the Oakland Scavenger Company), it serves the cities of Fremont, Newark, and Union City.

The 255-acre site is expected to remain active for approximately 25 more years. At the present time, almost 110,000 tons per year are received. Land uses in the surrounding area include industrial and agricultural with the Southern Pacific Railroad tracks and salt evaporators adjacent to the landfill operation. The landfill accepts Group 2 wastes, with some exceptions.

The Fremont site is inspected by Alameda County Health Care Services Agency (weekly), Regional Water Quality Control Board (periodically), and the Bay Area Air Pollution Control District (if complaints are received). The Alameda County Water District checks the ground water monthly; however, the well is monitored for sodium chloride content only.

The 26-acre Pleasanton Public Dump is a non-conforming use in an area zoned Agricultural and is owned and operated by the Pleasanton Garbage Service and located adjacent to Arroyo del Valle approximately one-half mile east of Pleasanton. A refuse disposal operation was present on the site before the area was first zoned in 1956. The site upslopes and extends in an average of 1,700 feet from Vineyard Avenue, with the refuse fill operation occurring near the center and rear of the property in a gully.

Group 2 wastes are accepted from the City of Pleasanton and the surrounding area at the rate of about 20,000 tons a year. The land uses in the surrounding area include vineyards, grazing lands, and scattered single-family dwellings. The site is approximately one mile east of residential development in the City of Pleasanton. Extensive quarry operations are located to the north.

Agencies are responsible for inspection include the Regional Water Quality Control Board, Alameda County Health Care Services Agency, the Bay Area Air Pollution Control District, and the State Division of Forestry. The operation is subject to the County Ordinance on garbage disposal.

The Eastern Alameda County disposal site, which began in 1973, is located on Vasco Road in the unincorporated area northeast of the City of Livermore. Total area in the site is 297 acres of which about 103 acres are presently planned for refuse fill. Remaining capacity will depend upon the future service area; but at the present rate of fill (50,000 tons annually), the site is expected to last past the year 2000. The Vasco Road site is presently serving the Livermore Area and the communities of Dublin and San Ramon.

Land uses in the surrounding areas are agricultural and residential, with five residences in the immediate vicinity of the access road. The Alameda County General Plan designates the area as "Uncultivated and Undeveloped," and present zoning is "A-2" (General Agriculture).

The Eastern Alameda County disposal site is owned by Ralph Properties, Inc., and operated by the DePaoli Equipment Company. The operation is fill and cover in a swale between two ridges with diversion of the natural drainage channel to permit dumping.

The site is periodically inspected by the Regional Water Quality Control Board and occasionally reviewed by the Bay Area Air Pollution Control District. Regular inspection is initiated by the Alameda County Health Care Services Agency (monthly), by the Alameda County Building Inspection Division of the Public Works Agency (annually to semi-annually), and by the State Division of Forestry (during the fire hazard season).

LOCATION MAP
ALAMEDA COUNTY SOLID WASTE DISPOSAL SITES

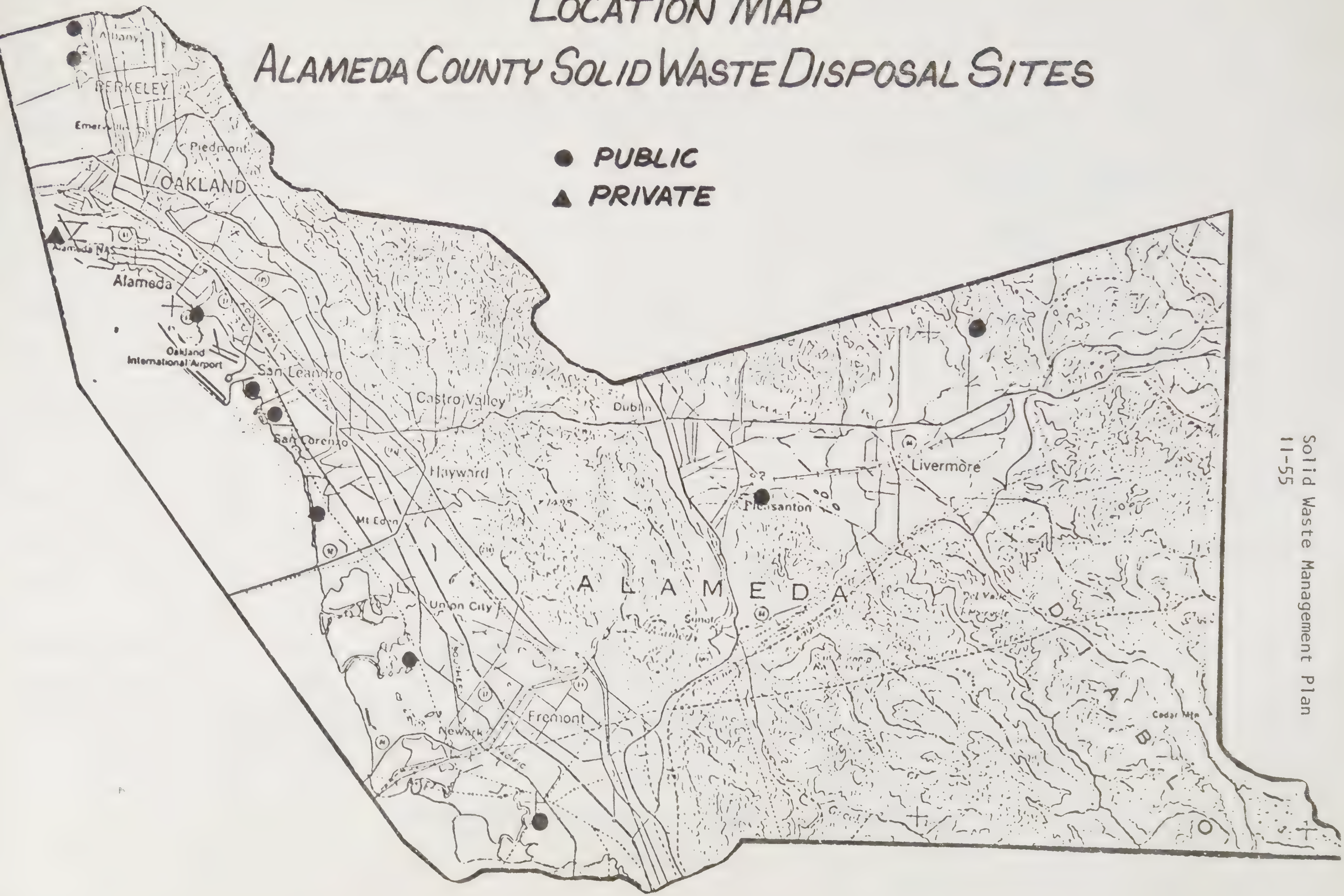

TABLE II-21

ALAMEDA COUNTY SOLID WASTE DISPOSAL SITES, FALL, 1974

Site	RWQCB Classification	Size of Fill (Acres)	Daily Tonnage	Remaining Capacity (Yrs.)	Service Area
Alameda (City)	None	29	110	0	Alameda.
Alameda NAS	None	less than 100	160	8	Naval Air Station, excluding housing.
Albany	II-2	105	200	5-10	Albany, adjacent communities.
Berkeley	II-2	40	375	3-6	Berkeley, adjacent communities.
Davis Street	II-2	200	1,029	2-2.5	Albany, Emeryville, Oakland, Piedmont, San Leandro, Hayward, Oro Loma & C.V. San. Dists.
Eastern Alameda Co.	II-2	103	165	30	Livermore, unincorporated area.
Fremont	II-2	255	300	25	Union City, Newark, Fremont
Marina	II-2	135	100	2	Oakland, San Leandro, Oro Loma & C.V. San. Dists.
Pleasanton	II-2	26	75	1.5	Pleasanton, unincorporated area
Turk Island	II-2	73	30	8	Hayward, Union City, Newark, Fremont, unincorporated area
West Winton	II-2	59	0	0	(Closed)

6. Existing Government Controls:

The administration, collection, transportation, and disposal or salvage of solid wastes in Alameda County is currently regulated at five different levels of government: city, district, County, State, and Federal. Each of the thirteen cities in the County has an ordinance specifying in various degrees of detail the procedures and method of handling its solid wastes. Likewise, all but the sparsely populated unincorporated territory are managed by one of three sanitary districts. The Health Departments of both the County and the State retain some general control of the potentially hazardous areas of solid waste management. The policies and ordinances of the Bay Conservation and Development Commissions and the Regional Water Quality Control Board also regulate solid waste, mostly in the disposal stage. Lastly, the Federal Government's Army Corps of Engineers has jurisdiction over "navigable waters" giving that agency some regulatory control powers in cases of shoreline disposal sites or dumping at sea.

The methods, procedures, and standards for management of solid wastes are specified in either a local ordinance code or in a contract. The intention of the local ordinance code is to protect the public interest; violation normally constitutes a misdemeanor. However, many local ordinances are outdated and in need of revision. The contract is an agreement between parties as to the specific performance standards of each party. For example, a city has a public responsibility to see that solid wastes are properly handled within its jurisdiction and may elect to enter into a contract with a private company to fulfill this responsibility.

County Government and Solid Waste Management:

Within County government, there are currently four agencies involved with solid waste management. The Planning Department is responsible for the County-wide Plan. The County Health Agency is concerned with public health and sanitation problems, as well as vector control. The Agricultural Commissioner regulates the disposal of used pesticide containers. Finally, the Building Inspection Department investigates and enforces conditions imposed in use permits in the unincorporated areas.

Perhaps the largest role in the regulatory picture is now occupied by the County Health Department. The Environmental Health Division of the Health Care Services Agency is responsible for the following:

1. Observation and inspection of waste disposal activities, waste storage and handling, programs relating to solid waste management as well as rodent and insect control.

2. Enforcement of sanitary standards and investigation of complaints in these areas.

3. Regular inspection of disposal sites under County's jurisdiction (unincorporated areas and cities under contract) for unsanitary conditions including insufficient cover, compaction, evidence of vectors, and blowing papers.

4. Enforcement of the County Ordinance, Chapter 4 of the Health and Safety Code, "Regulations of Garbage Accumulation, Collection, and Disposal."

5. Assistance in the preparation of the County Solid Waste Management Plan through the Solid Waste Management Plan Advisory and Technical Advisory Committees and on an ad-hoc committee basis.

The responsibilities of the Public Works Agency and the Agricultural Commissioner, although regulatory in nature and important in the overall sense, are minor aspects of the waste management picture procedure. The Planning Department has an overall coordinating and research role, which is the initial stages of implementation under existing legislation. The following are the duties of the Planning Department:

1. Coordination and developing a County-wide solid waste management plan according to the State Solid Waste Management Board's guidelines and policies.

2. Collecting data on all aspects of solid waste management practices in Alameda County and on solid waste systems implemented in other areas.

3. Reviewing all use permit applications for the establishment of any solid waste processing, transfer, and disposal facility in the unincorporated areas.

4. Writing environmental impact statements on proposed waste disposal facilities.

5. Providing staff support to the Solid Waste Management Plan Advisory and Technical Advisory Committees, the Planning Commission, and the Board of Supervisors.

6. Reviewing State Solid Waste Management reports; reviewing site applications in incorporated areas.

D. Evaluation of Existing Systems

1. Refuse Collection and Disposal:

The two most significant aspects of the existing solid waste management system in terms of public satisfaction and cost are the collection and disposal functions. Collection presently accounts for nearly ninety percent (90%) of system costs. It is the part of solid waste management most visible to the general public. Disposal of collected refuse has a direct impact on the natural environment. Landfill disposal has produced social costs, which have not been quantified, as a result of adverse environmental impacts and a loss of natural resources. This analysis focuses on the methods and costs associated with collection and disposal of municipal refuse.

Urban collection systems generally consist of three types of service: garbage collection (residential and commercial) by side and rear loader packer trucks; container service by a front-end loader truck; and drop box service (industrial customers) by a "piggyback" or drop box truck. Most municipal wastes are collected by the side, rear, and front-end loaders.

Collection/Disposal Costs

A detailed description of capital, time-operating, salary, usage costs per mile, and typical collection costs is given in Section VI, "Economic Analysis and Feasibility," and will be highlighted here. Labor (salaries and fringe benefits) costs form the major part of collection expense, comprising over 50 percent of the cost of operations. Collection cost per ton increases with crew size.

1974 Annual Collection Cost by Crew Size

2 - Man Crew	\$ 66,470
2.75 - Man Crew	\$ 79,970
4 - Man Crew	\$102,470

1974 Collection Cost Per Ton by Crew Size

2 - Man Crew	\$30.99
2.75 - Man Crew	\$37.28
4 - Man Crew	\$47.77

In 1974, the average crew operating a collection vehicle in Alameda County consisted of 2.75 men, travelling about 45 miles per day (8 hours) and collecting an average of 8¼ tons of solid waste, 260 days per year. Collection cost included time operating cost, truck operating cost, and salary cost. Also, the cost of collection service included a charge for disposal at the landfill, since this fee is a collection expense and a revenue for the disposal site operation. The public pays for disposal through the collection service charge.

Front-end loader container service and drop box service are more profitable for the collector than is residential service.[1] The front-end loader and drop box vehicles are operated by one man, while the side and rear loaders are operated by two-man to four-man crews. In addition, there has appeared to be a tendency for some jurisdictions to minimize increases in rates to residential customers by offsetting the resulting revenue deficiency with higher rates for commercial users.[2]

Organization of Collection Routes in 1975

Alameda City Disposal organizes its routes according to work load and a geographical unit. The City of Alameda is divided into 12 geographical sections or routes. One section corresponds to one week's work (5-day week). Nine routes service primarily residential customers. Three routes provide commercial and industrial container and drop box services.

The City of Berkeley's routes are based on a 7½ hour working day and on a geographical area. The City is divided into three districts. Within these districts, there are 19 trucks operating daily or 19 routes. Sixteen packer trucks operate in the flatland and hill areas. Each daily route involves about 575 cans. Three front-end loaders operate in the flatlands. Each daily route handles about 200 containers.

The Oakland Scavenger Company's 169 routes--112 residential/commercial, 19 front-end loader, and 38 drop box trucks--are organized by dollar volume of collection receipts so that each route generates the same income. The collection crews of two to four men operate on a standard task day. Having completed their route collections, the men do not have to find further work to do to fill an eight-hour day. This method has historically been used by the Company. Routes are adjusted twice each year, and the same territory is covered by the crew each week. Even though the City of Oakland Division is separate from the other parts of the Company for accounting purposes, crew work loads and physical locations cause route truck crews to split collection time between Oakland and the adjacent cities of Piedmont, Emeryville, and Albany. The Hayward Division splits routes between Hayward and Castro Valley Sanitary District. Thus, route organization is not constrained by jurisdictional boundaries in the Company's service area.

The City of San Leandro's routes are determined by work load and are adjusted whenever necessary. Each route corresponds to one week's work by one truck. There is a total of 12 routes - 8 residential and 4 commercial. Residential routes are based on a 5-day week; commercial routes are based on a 6-day week. Therefore, 12 collection vehicles operate daily (Monday-Friday) with 4 vehicles operating on Saturday.

The Pleasanton Garbage Service, Inc.'s routes are organized by work load which is defined as a 7.5 hour day and comprising the collection of 750 cans per route. The Service operates 6 routes--4 rear loaders for residential-commercial collection, 1 front-end loader, and 1 drop box vehicle. All collection services operate on a 5-day week.

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[1] Joint Refuse Rate Study Technical Committee.

[2] Price Waterhouse and Company, Joint Refuse Rate Study (May 23, 1972), p. 9.

In summary, collection routes are organized by two methods--work load and monthly dollar volume. The work load method is used by all of the collection services except Oakland Scavenger and its collection divisions. With the work load method, the service area is divided into geographical sections. The sections are divided into areas or routes comprising five days or one week's work by one truck. Each route is based on a 7½ to 8 hour working day by each crew.

The Oakland Scavenger Company's method of designing routes to yield the same monthly revenues means that the length of the working day varies from route to route. Also, crew sizes and the "standard task day" are affected by the abilities of the men assigned. Younger employees are assigned to more physically demanding routes, and older men are assigned to three- and four-man crews on level terrain. The mix of hillside and level terrain routes is the same for each collection division except for the Dublin and Livermore operations. Some hillside routes with two-man crews can collect as much refuse as some four-man routes on level terrain. Thus, collection cost per ton is low on two-man routes and increases with crew size.

Collection Rates, 1975

Residential and commercial refuse collection service charges vary widely among the jurisdictions. At the low end of the scale, customers in the Cities of Piedmont and Emeryville pay only $1.90 per month for weekly pick up of one 30-gallon can and $2.20 per month for weekly pick up of two 30-gallon cans. At the opposite end of the scale, the City of Hayward and the Castro Valley Sanitary District customers are charged $2.90 per month for weekly pick up of one 32-gallon can and $4.80 per month for weekly collection of two cans of refuse. In all of the jurisdictions, the rates for pick up of additional cans decrease with the number of cans. For example, the residents of Oakland pay $2.40 for the first can but only $1.60 for an additional can (weekly pick up). Thus, the more refuse one generates, the more economical it becomes to dispose of it if it is in a 30-32 gallon can. The highest rate for weekly pick up of two cans is $4.95 in the City of Alameda where the first can is assessed $2.70. Cubic yard wastes do not usually receive such a discount. Four collections of one cubic yard per collection would cost $6.80 in Emeryville and Albany and $11.65 in San Leandro. Rates for compacted cubic yards (based on a 2:1 compaction ratio) are double the rates for an uncompacted cubic yard.

Disposal Costs, 1975

The subscriber to the refuse collection service is not only paying for waste to be removed from the home or business, but is also paying for disposal of the waste in a landfill. The City of San Leandro is charged $3.25 per ton to utilize the Davis Street disposal site. Oakland Scavenger Company and any other refuse collection service is charged

\$3.75 per ton to dump refuse at the Eastern Alameda County disposal site on Vasco Road. (This charge was increased from \$3.00 per ton on March 1, 1975.) Within the Oakland Scavenger Company, the collection divisions are charged varying rates by the dump operations service divisions. Rates depend on quantity, type of waste (liquids), necessity for special handling, and the disposal site. The disposal sites charge different rates. Costs of collection and disposal are passed along to the customer through the monthly service charge and are the basis for requests to increase collection rates.

In terms of economic costs for the entire solid waste handling system, disposal operations account for only about ten percent of the total costs in Alameda County, according to the collection industry. Because refuse collection is labor-intensive and capital-intensive, this statement in not unreasonable.

The most significant costs to a landfill operation are land purchase, initial improvements to the site, and equipment financing. Land expense is dependent upon the purchase price of the land and is difficult to quantify for a general discussion. Equipment owning and operating costs are often the highest single expense. Labor costs may exceed 25 percent of the cost of the operation.

Capital requirements for sanitary landfill may be divided into three categories:

. land and land acquisition costs
. permanent improvement costs
. equipment costs

The major annual operating costs for a sanitary landfill are analyzed as follows:

. equipment owning and operating
. depreciation of permanent improvements
. interest on borrowed capital
. labor
. maintenance
. taxes, utilities, and miscellaneous

Landfill revenues come from disposal fees which vary from \$.50 to \$1.00 per cubic yard for private citizens and from \$3.25 to \$3.75 per ton for collection service companies.

In addition, a landfill operation will receive a credit other than revenue from "dump charges" on the trade-in value of the equipment.

A more detailed discussion of capital costs and operating expenses is included in Chapter VI, "Economic Analysis and Feasibility."

Landfill disposal operations are likely to be more expensive in the future as governmental agencies adopt stringent regulations and higher standards of operation and as they begin to seriously enforce the regulations and standards. It will be more expensive to operate a landfill as a "sanitary landfill" than as a modified landfill. Site development costs are likely to increase due to the addition of environmental pollution controls (for leachate, surface water, and gas) where they are necessary and scales for weighing incoming trucks and refuse. Inexpensive marshlands are no longer available for locating land disposal site. Future landfill sites will likely be located in remote areas requiring long distance hauling of the refuse from its source of generation.

Enforcement and inspection costs for monitoring landfill oprations have not been quantified, and neither have the environmental pollution costs from past and existing operations been quantified. Nevertheless, these costs should be considered in discussions of the landfill method as being the most inexpensive method of solid wastes disposal.

2. Franchise Operations in the Disposal Service Areas:

The sixteen jurisdictions responsible for providing garbage collection service to the public have either contracted with private companies or have elected to operate the service themselves (Berkeley and San Leandro).

Fourteen jurisdictions have granted <u>exclusive</u> franchises to private firms for municipal refuse collection and some types of industrial waste collection. The franchise grants to the collector the exclusive privilege to collect all refuse in the local area; no other collection service may legally operate in that area. The Cities of Alameda and Pleasanton have granted franchises to two small private collectors. The other twelve jurisdictions have granted exclusive contracts to the Oakland Scavenger Company, one of the largest private collection firms in the United States.

The exclusive contract (franchise) gives the firm monopoly control by eliminating competition, especially when few private firms are operating in an area. In order to avoid monopoly exploitation, some form of public price control and standards of service regulation is implemented by the local government.

In Alameda County, local jurisdictions outline standards of service (such as frequency of pick up, maintenance of collection vehicles, and hours of collection) and rates in the contract with the firm. It is a responsibility of the local regulatory body to establish rates based on an analysis of the firm's costs and the determination of a fair rate of return. In recent years, the rate review process in the County has come under criticism by both the industry and the public sector as being time-consuming and inadequate.

The rate review process in Alameda County is usually initiated by the private firms. Rates are established in the contract usually for a specific period of time after which they are either continued or renegotiated. Sometimes the company will request a rate increase before the expiration of current rates if unforeseen costs occur. The process begins with the submission of financial data and projected expenses such as usage increase; employee salary, health, and welfare increases; and construction or equipment purchase expenses. Based on projected expenses and a rate of return on total investments, the collector proposes service rates which will cover the expenses and insure him of a fair profit. The jurisdiction analyzes the projected expenditures, the determination of fair return on investment, and the development of a rate schedule to support the operation.

In attempting to match the cost changes with additional revenue, the collection company most often proposes changes in the residential, commercial, and industrial rate structures according to the expected cost increases. Therefore, if residential service has the largest projected cost increase, then the proposed rate for residential service will show the largest increases.[1] In their review of the rates, the local jurisdictions have often modified the firm's proposed rates to offset large increases in residential rates by increasing commercial rates above the amount indicated by projected expenses. In one jurisdiction, the private collector proposed rate increases of about 39 percent for residential service and 11 percent for commercial. After conducting a rate survey of fees in other jurisdictions, the city then recommended a 22.5 percent increase for both services. Hence, the commercial collection activities are subsidizing residential service.

The effectiveness and equitability of the rate review process is dependent upon the financial information supplied by the company and the expertise of staff auditors and financial analysts in the local jurisdictions in determining the rate structure.

The financial information supplied by the collection service is crucial to the setting of equitable rates. Accounting procedures which <u>clearly</u> illustrate all costs and revenues generated by the provision of collection and disposal service are significant to the rate review process. In the Cities of Alameda, Berkeley, San Leandro, and Pleasanton, the collection systems each provide service to only one jurisdiction. Thus, costs generated will apply to each distinct jurisdiction, and the rate review process is relatively simplistic; but the Oakland Scavenger Company operates at a subregional level, serving twelve jurisdictions. The rate review process becomes complicated as each jurisdiction attempts to analyze the costs pertaining to their individual areas, while the Company's accounting procedures are based on the activities of their collection and service divisions which provide services to more than one jurisdiction. In order to better comprehend the complexity of the rate setting procedure as it applies to Oakland Scavenger and its

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[1]Price Waterhouse and Company, Joint Refuse Rate Study (May 23, 1972), p. 8.

disposal service areas, a brief discussion of the Company's organization and accounting procedures follows.[1]

The Oakland Scavenger Company is organized into 17 divisions: 8 provide garbage and refuse collection services; 4 are connected with landfill site operations; and the rest are involved in other service or auxiliary activities including truck maintenance, real estate, and paper stock operations. The collection divisions provide 4 types of service: residential and commercial garbage and refuse collection from regular garbage cans and rear-loader containers (5 divisions), drop box service, front-end loader container service, and cannery waste disposal service.

The Company's accounting procedures allocate revenues and expenses to garbage collection divisions and other divisions to facilitate the preparation of financial statements by divisions. For example, the garbage collection divisions are charged by the truck maintenance division for parts and labor and by the dump site divisions for disposal of collected refuse. All refuse collection revenues recorded in division accounts are reported to each jurisdiction according to the amounts which apply to the individual jurisdiction; but, in preparing financial statements for franchise reporting or rate setting purposes, the expenses recorded in the collection divisions are re-allocated to the jurisdiction in proportion to the revenue received. Thus, there may not be a precise matching of collection revenues with expenses in each area.

The important aspects of Oakland Scavenger's organizational structure and accounting procedures which relate to the rate review process are as follows:

1. Truck maintenance charges and disposal fees are recorded as expenses by the collection divisions. Total expenses are then allocated to the jurisdictions for the determination of collection rates; but truck maintenance charges and disposal fees are recorded as revenues in other service divisions which are not included in the rate review process. In other words, these revenues are not included with collection revenues in determining rate increases.

2. The reallocation of collection division expenses to the jurisdiction in proportion to the revenue received may result in imperfect matching of collection revenues with expenses in each area. Expenses do not necessarily vary in direct relation with revenues. (Revenues are influenced not only by expenses but also by political decisions on the part of each jurisdiction.)

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[1]The discussion is based on the description of Oakland Scavenger Company in the Joint Refuse Rate Study by the Price Waterhouse and Company (May 23, 1972).

The expertise of staff auditors and financial analysts in the jurisdictions is important in establishing rates which are fair to the industry and the public. The various jurisdictions have different staff resources, and not all are able to conduct detailed reviews. After staff review, the recommended rate schedule is submitted to the city council or board of directors for further review, modification, and final adoption. This entire process has been time consuming.

The method of determining the rate structure in Alameda County has been for each jurisdiction to establish rates to offset overall projected costs (including a return on investment) by adjusting increases in residential and commercial rates. Ten jurisdictions have formed the Joint Refuse Rate Committee to revise the rate setting procedure with the Oakland Scavenger Company. These jurisdictions, in conjunction with the Company are in the process of developing the Operating Ratio Method to determine revenue requirements of the Company. The revenue requirements of a regulated company are the total of operating expenses and a return on capital investment.[1] It is defined in the following formula:

$$\text{Operating Ratio} = 1 - \frac{\text{Return on Invested Capital (\$)}}{\text{Operating Expenses + Return on Invested Capital (\$)}}$$

The total revenues the Company would receive from all jurisdictions would be based on the relationship or "ratio" of total operating expenses to total revenue requirements.[2] The Joint Refuse Rate Study, prepared for the Committee by Price Waterhouse and Company, recommends that the same operating ratio should be used for all jurisdictions in their individual determination of collection rates chargeable to customers in their jurisdictions.

Each jurisdiction has been responsible for setting collection rates and for enforcing the terms of their contracts with the private firms. Because the collection service has a highly significant impact on the well-being of the community, this regulatory review function of the local government should not be ignored by local administrators. At the same time, it is also recognized that not all local jurisdictions have the resources to adequately evaluate operating expenses, review comparative statistics, monitor efforts to enforce exclusive franchise agreements, recommend the return on capital rate, and negotiate individual operating ratios and incentive programs to reduce operating costs. The Joint Solid Waste Committee is not empowered to perform all these functions and it is only composed of jurisdictions contracting with Oakland Scavenger. A County-wide agency with the authority to implement the solid waste management plan and to conduct continuing solid waste planning could have the staff resources to perform these functions and assist the cities and special districts in establishing future rate schedules and in reviewing franchise operations.

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[1] Price Waterhouse and Company, Joint Refuse Rate Study (May 23, 1972), p. 17.

[2] Price Waterhouse and Company, Joint Refuse Rate Study (May 23, 1972), p. 2.

3. Review of Landfill Sites

A review of landfill disposal sites in Alameda County was made in the Fall of 1974 and included an evaluation of site operations and problems, existing fill activities, environmental problems, and future plans for the sites. A complete review of county landfills is included in the Background Report on Landfills (See Appendix A) and will be summarized here.

Disposal operations at four sites began in the 1960's. One landfill operation commenced in 1970, but fill activities in areas adjacent to the site began in 1951. In general, the landfills have a long history of problems relating to vectors, air quality, and water quality. With the advent of more stringent environmental and health laws, disposal operations at most of the landfills have improved in recent years. However, none of the sites presently in operation in the County may be considered a "sanitary landfill." Violations of air and water quality regulations occur periodically at most of the sites. Water quality problems are observed more frequently at several of the sites which are adjacent to the San Francisco Bay than at the inland sites.

The Albany Landfill has been temporarily closed until the development plan can be revised. This site is actually a combination of landfill and bayfill, and most of its operational problems relate to its immediate proximity to the San Francisco Bay. The quality of bay waters seems to be minimally preserved from impairment by the reclamation fill activities. The potential for present and future degradation of the water is a legitimate concern. Occasional illegal dumping by "night haulers" in areas adjacent to the landfill site could adversely affect water quality. Waste materials are deposited in unsealed cells, with water entering the cells through tidal action, producing leachate which flows back into the Bay. These cells are constructed below the water level. The Albany Landfill presents a potential problem with respect to air pollution, for the prevailing winds in the area would blow the smoke and particulate matter from accidental fires at the site toward the developed areas in the City of Albany. In the event of an earthquake producing a tsunami having a runup of 20 feet at the Golden Gate Bridge, the site would probably be inundated and the fill saturated, increasing the production of leachate.

The Berkeley Landfill is another bayfill disposal site located in a tideland area with a history of operational problems since 1968. These problems include seepage, odor, refuse in contact with water, and open fires. Evidence indicates that the dikes are permeable; thus, there is potential for further contamination of surface waters by water which has been in contact with the refuse (leachate). The Berkeley Landfill receives both garbage and rubbish, yet the waste is only covered weekly. Putrescible material is left uncovered for long periods, increasing the chances for odors and vector problems. Because of its location, the possibility exists for inundation by tsunamis with subsequent leachate production.

The Alameda City Disposal Site is long overdue for closing. As the refuse fill becomes higher and higher, the underlying soft, compressible Bay Mud reacts to its increased load by producing mud waves. The site was developed in a flood plain adjacent to the San Leandro Channel. The levee is permeable, permitting bay water to flow in and out of the fill under tidal action, adversely affecting the quality of surface waters. Use of the site is limited by city ordinance to residents of Alameda. Yet, the ordinance is difficult to enforce and "illegal" dumping occurs. The working face is covered weekly.

The Alameda Naval Air Station Site is also adjacent to the Bay. The present disposal operation was preceeded by dumping dredge spoils and refuse in the Bay. The primary locational concern is the effect of the disposal operations on adjacent surface waters. The site is not under the jurisdiction of local agencies; it is managed by U. S. Navy personnel. While impairment of water quality occurred in the past, existing conditions have not been determined.

The Davis Street Site in San Leandro is a bayfill on approximately 220 acres. Because it is located adjacent to the San Francisco Bay and because it has exhibited evidence of seepage and discoloration in the adjacent surface water, the potential for further contamination is great. Disposal operations began in 1942, before a minimum setback of 50 feet from the edge of the Bay was established. Areas of old refuse fill are within 50 feet of the Bay, and the area next to the dikes is subject to inundation by waves and tidal action. The site is located in an area of potential inundation by tsunamis. Davis Street receives municipal garbage and rubbish fron the Central Metropolitan Planning Unit Disposal Service Area, and cover is applied only once every 4 to 7 days, leaving putrescible wastes exposed. The vector control program works effectively to control the rat population.

The San Leandro Marina Disposal Site is located adjacent to San Francisco Bay. The levees are believed to be relatively impermeable to surface waters, but discoloration of ponded water in the site has occured in the past. The potential seems to exist for contaminated ponded water to drain into the Bay. Since most of the material received is Group 3 waste and dry rubbish, cover is applied only once every one to two weeks. Saturation of the fill might occur in the event of a sizeable tsunami.

The West Winton Disposal Site was closed in November, 1974. The filled area is in proximity to the San Francisco Bay. If leachate is generated and allowed to escape, then degradation of surface water quality could occur.

The Turk Island Company landfill site poses several locational concerns with respect to environmental degradation. It is located adjacent to San Francisco Bay and a flood control ponding facility; this could cause degradation of water quality by leachates and siltation in the channel. The proposed 40-foot height of the fill could create land stability

problems in the vicinity of the site (land heaving and mud waves). This proposed height will also have a significant visual impact, for there has been a change in land use character in the area. Industrial use of adjacent lands is no longer planned by the City of Union City, and residential and open space uses are being emphasized. Strong westerly winds may aggravate such problems as odors, dust, and blowing papers. The distance separating the bottom of the fill and groundwater may be one foot. While the character of the existing groundwater is saline, it should not be degraded by leachate, a potential problem. Cover material is applied once every 10 to 14 days.

The Durham Road (Fremont) landfill site is located in a flood plain and is adjacent to a flood channel embankment and to waters of the San Francisco Bay. Therefore, it is proximity to natural surface waters. While the levees are believed to be relatively impermeable and leachate problems have not yet been reported, the potential for leachate production and degradation of surface water quality is present. The disposal site overlies usable groundwater; leachate might reach the Centerville Aquifer which is used for irrigation and domestic purposes. Cover material is applied daily except on the working face which is covered once every 5 days. Thus, putrescible material is left uncovered for several days.

The Pleasanton Public Dump is in proximity to Arroyo del Valle, and groundwater below the site is contiguous with the groundwater in the Livermore Valley. The waters of Arroyo del Valle and the Livermore Valley Groundwater Basin have many beneficial uses. Thus, the location of the site does present some concern with respect to potential impairment of surface and groundwater quality. Residential development is approaching the site. The site is scheduled to be closed within a year, after construction of a transfer station is completed. Cover material is applied over exposed areas every other day.

The Eastern Alameda County Disposal Site is adjacent to an intermittent stream, which is tributary to Arroyo Las Positas, and is located in a natural drainage channel in a narrow canyon. A dam was constructed to prevent refuse from being washed out of the area by flash floods, and a drainage system was built to carry water away from the refuse fill and into a nearby stream. Should the refuse become saturated, subsequent surface and subsurface drainage from the site could affect water quality in the Livermore Valley. Bacterial contamination of the groundwater below the site occurred and was attributed to the acceptance of septic tank pumpings. As a result, raw sewage waste is now prohibited from the site. Cover material is applied daily, and the working face is usually covered at the end of each operating day. The Eastern Alameda County site is the only landfill in the County which might be considered a sanitary landfill.

Alameda County has several landfill sites which will be filled in the near future: Alameda, San Leandro Marina, and the Pleasanton Public Dump. The West Winton site is presently closed and a transfer station is being constructed on the site. The Alameda site will be used for recreation after closure, and the Marina site is to become a golf course.

The cessation of disposal operations at a landfill site does not signify an end to activity at the site. An adequate layer of final cover material must be applied which is significant to support the planned vegetation. The site must be properly sloped and graded to minimize the erosion of the cover and ponding of water on the surface. Gas and water controls may be required depending on the natural characteristics of the site. Periodic maintenance of the closed site includes gas and leachate monitoring, subsidence and settlement monitoring, and inspection of the final cover for cracks and erosion.

State regulations prohibit the abandonment of a landfill operation without the establishment of methods to protect the quality of surface and groundwater. Title 23, Chapter 3, Subchapter 15, Waste Disposal to Land includes the following:

> "2535. Completion of Disposal Operations. (a) Prior to cessation of disposal operations at a waste disposal site, the operation shall submit a technical report to the appropriate regional board describing the methods and controls to be used to assure protection of the quality of surface and groundwaters of the area during final operations and with any proposed subsequent use of the land. This report shall be prepared by or under the supervision of a registered engineer or a certified engineering geologist.
>
> (b) The methods used to close a site and assure continuous protection of the quality of surface and groundwater shall comply with waste discharge requirements established by the regional board.
>
> (c) The owner of the waste disposal site shall have a continuing responsibility to assure protection of usable waters from the waste discharge, and from gases and leachate that are caused by infiltration of precipitation or drainage waters into the waste disposal areas or by infiltration of water applied to the waste disposal areas during subsequent use of the property for other purposes."

Local ordinances generally do not stipulate requirements for closing the site. Some of the contracts between the city and the operator specify procedures for site completion: final height, depth of final cover, final land use, and maintenance responsibility. In general, however, there are few regulations dealing with the completion of a landfill site.

Completed landfills can be used in several ways; but their ultimate use is dependent upon the density of the solid waste, settlement, bearing capacity, and gas production. These characteristics are related to the type of waste buried and the degree of compaction achieved. Typically, a completed landfill has been used for open space, recreation, agriculture, and light construction.

In general, regulation of land disposal operations by regional, county, and city agencies is not performed consistently. Many agencies (whether city or county) do not regulate disposal operations within their jurisdiction because they do not view this function as one of their traditional duties. Thus, few agencies are knowledgeable about the landfill operators' plans for site development including fill procedures and implementation of environmental controls. While present federal and State laws call for safe and efficient land disposal of solid wastes, existing local ordinances and enforcement procedures are not adequate to fulfill the intent of these regulations.

Regulatory responsibility was found to be fragmented; that is, no single agency is maintaining supervision over all activities at a site. Instead, the typical mode is that each involved public agency concentrates on only one aspect of disposal operations. There was some indication that local and regional agencies are beginning to coordinate their surveillance activities. Air and water pollution control agencies, the County Health Department, and the County Agricultural Commissioner are now working together on some of the problems associated with land disposal of wastes. However, no comprehensive monitoring of County landfill sites is presently occurring.

Alameda County is rapidly reaching the limit of its present landfill capacity and the highly populated metropolitan areas will soon be without a general purpose, close-in disposal site. The West Winton site near Hayward ceased operations in November, 1974. The City of Alameda's site is long overdue for closure. The Albany site has an undetermined remaining capacity for selected materials if its legal problems are resolved. Berkeley's site has 5 years active life remaining for its limited service area. The San Leandro Marina site will be completed in less than 2 years. The major disposal facility for the Central Metropolican Planning Unit, the Davis Street site, will be closed in less than 2.5 years. The South County area will be able to use the Fremont landfill for another 25 years. The Eastern Alameda County landfill will be capable of filling the disposal needs of the Livermore-Amador Valley area for another 30 or so years. The Pleasanton Public Dump will be closed within a year.

In summary, Alameda County's land disposal sites are not being required to operate as sanitary landfills, and most of the sites are responsible for creating adverse environmental impacts. The present solid waste land disposal system generally lacks the following: (1) adequate regulation of site design and operations, and (2) adequate capacity to handle all solid wastes generated in Alameda County in the near future. This shortage of landfill capacity is an existing concern

Alameda County has several landfill sites which will be filled in the near future: Alameda, San Leandro Marina, and the Pleasanton Public Dump. The West Winton site is presently closed and a transfer station is being constructed on the site. The Alameda site will be used for recreation after closure, and the Marina site is to become a golf course.

The cessation of disposal operations at a landfill site does not signify an end to activity at the site. An adequate layer of final cover material must be applied which is significant to support the planned vegetation. The site must be properly sloped and graded to minimize the erosion of the cover and ponding of water on the surface. Gas and water controls may be required depending on the natural characteristics of the site. Periodic maintenance of the closed site includes gas and leachate monitoring, subsidence and settlement monitoring, and inspection of the final cover for cracks and erosion.

State regulations prohibit the abandonment of a landfill operation without the establishment of methods to protect the quality of surface and groundwater. Title 23, Chapter 3, Subchapter 15, Waste Disposal to Land includes the following:

> "2535. Completion of Disposal Operations. (a) Prior to cessation of disposal operations at a waste disposal site, the operation shall submit a technical report to the appropriate regional board describing the methods and controls to be used to assure protection of the quality of surface and groundwaters of the area during final operations and with any proposed subsequent use of the land. This report shall be prepared by or under the supervision of a registered engineer or a certified engineering geologist.
>
> (b) The methods used to close a site and assure continuous protection of the quality of surface and groundwater shall comply with waste discharge requirements established by the regional board.
>
> (c) The owner of the waste disposal site shall have a continuing responsibility to assure protection of usable waters from the waste discharge, and from gases and leachate that are caused by infiltration of precipitation or drainage waters into the waste disposal areas or by infiltration of water applied to the waste disposal areas during subsequent use of the property for other purposes."

Local ordinances generally do not stipulate requirements for closing the site. Some of the contracts between the city and the operator specify procedures for site completion: final height, depth of final cover, final land use, and maintenance responsibility. In general, however, there are few regulations dealing with the completion of a landfill site.

Completed landfills can be used in several ways; but their ultimate use is dependent upon the density of the solid waste, settlement, bearing capacity, and gas production. These characteristics are related to the type of waste buried and the degree of compaction achieved. Typically, a completed landfill has been used for open space, recreation, agriculture, and light construction.

In general, regulation of land disposal operations by regional, county, and city agencies is not performed consistently. Many agencies (whether city or county) do not regulate disposal operations within their jurisdiction because they do not view this function as one of their traditional duties. Thus, few agencies are knowledgeable about the landfill operators' plans for site development including fill procedures and implementation of environmental controls. While present federal and State laws call for safe and efficient land disposal of solid wastes, existing local ordinances and enforcement procedures are not adequate to fulfill the intent of these regulations.

Regulatory responsibility was found to be fragmented; that is, no single agency is maintaining supervision over all activities at a site. Instead, the typical mode is that each involved public agency concentrates on only one aspect of disposal operations. There was some indication that local and regional agencies are beginning to coordinate their surveillance activities. Air and water pollution control agencies, the County Health Department, and the County Agricultural Commissioner are now working together on some of the problems associated with land disposal of wastes. However, no comprehensive monitoring of County landfill sites is presently occurring.

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because of the County's almost total dependence on the landfill method of solid waste disposal at the present time. The highly populated metropolitan areas produce the bulk of municipal wastes and generally lack close-in sites of large capacity capable of accepting all types of Group 2 wastes. However, if large-scale resource recovery programs are implemented, then existing sites could handle the reduced volume of waste for several years. Large quantities of material could be diverted from landfills into materials and/or energy recovery facilities.

For example, of the solid wastes (municipal) estimated to be produced in the Central Metropolitan and Eden Planning Units in 1980, or 870,600 tons, only 67,300 to 70,500 tons would be landfilled if selected materials and energy recovery systems were implemented--i.e., the San Francisco Bay Resource Recovery Demonstration Project and/or the Oakland Scavenger Company and EBMUD/PG&E project proposals for an East Bay Energy and Resource Recovery System. The 1,083,400 tons of waste presently being disposed in County landfills could shrink to as little as 387,300 tons in 1980 and to 117,100 tons in 1990 assuming full-scale resource recovery. The Fremont and Eastern Alameda County landfills are capable of handling together some 167,400 tons annually for 25 or so more years or about 279,000 tons annually for 15 years, for example.

Of course, until major resource recovery systems are implemented, existing landfills will be required to bear the entire solid waste burden. A landfill facility will always be required to handle the residues of any resource recovery program; but with the immediate planning and development of large-scale recovery programs, a landfill capacity crisis can be averted in the short term.

4. Resource Recovery

Resource recovery from solid wastes has the potential to aid in solving two major problems: (1) the difficulty in disposing of solid wastes safely and effectively and (2) the declining inventory of natural resources. Resource recovery reduces the amount of solid wastes that most be disposed in a land disposal site and provides an alternative source of raw materials for production thereby preserving virgin natural resources and avoiding their rapid exploitation.

The existing resource recovery system in Alameda County is disjointed and lacks comprehensiveness. The scrap industry, refuse collection industry, community recycling centers, and individual companies are all to be commended for their efforts to divert recyclables from the waste stream into secondary materials markets. Yet there is no innovative, imaginative program operating on a County-wide scale to extract reusable materials from the mountains of solid wastes being generated.

A thorough evaluation of secondary materials economics in Alameda County and the general factors affecting their supply and demand is given in Chapter VI. But the potential for resource recovery in the County is summarized in this section of the Plan.

There is an immense amount of potentially recoverable materials (270,800 tons/year in Alameda County) which are not being utilized. Table II-22 estimates the quantity and value (based on $300/ton for non-ferrous and $20/ton for all others) of the materials presently being lost to landfills. Technological limitations prevent the full recovery of these materials.

TABLE II-22

ESTIMATED GENERATION OF SOLID WASTE BY RECOVERABLE MATERIAL AND GROSS VALUE IN MUNICIPAL FRACTION:[1] ALAMEDA COUNTY AND FOUR CONSTITUENT PLANNING UNITS, 1975

Planning Unit	Total Generation (Tons/Yr.)	Ferrous Metals (8%) Amount (Tons/Yr.)	Ferrous Metals (8%) Value $ Million	Nonferrous Metals (1%) Amount (Tons/Yr.)	Nonferrous Metals (1%) Value $ Million	Glass (10%) Amount (Tons/Yr.)	Glass (10%) Value $ Million	Newspaper (9%) Amount (Tons/Yr.)	Newspaper (9%) Value $ Million	Corrugated Cardboard (22%) Amount (Tons/Yr.)	Corrugated Cardboard (22%) Value $ Million	Total Recoverable (50%) Amount (Tons/Yr.)	Total Recoverable (50%) Value $ Million
CMPU	544,500	21,800	$0.44	2,720	$0.82	27,200	$0.54	24,500	$0.49	59,900	$1.20	136,100	$3.49
EPU	265,300	10,600	$0.21	1,330	$0.40	13,300	$0.27	11,900	$0.24	29,200	$0.58	66,300	$1.70
LAVPU[2]	96,800	3,900	$0.08	480	$0.14	4,800	$0.10	4,400	$0.09	10,600	$0.21	24,200	$0.62
WVPU	176,800	7,100	$0.14	880	$0.26	8,800	$0.18	8,000	$0.16	19,400	$0.39	44,200	$1.13
COUNTY	1,083,400	43,300	$0.87	5,420	$1.63	54,200	$1.08	48,800	$0.98	119,200	$2.38	270,900	$6.94

[1] Municipal fraction is assumed to be half of the total generation.

[2] A portion of San Ramon, Contra Costa County, in included in the LAVPU data.

Based on the National Center for Resource Recovery's study on technologically feasible recovery rates, estimates of the tonnage and value of resource materials that could actually be recovered for marketing were developed. These estimates are illustrated in Table II-23.

TABLE II-23

ESTIMATED MAXIMUM OUTPUT AND NET VALUE OF MATERIALS SEPARABLE FROM SOLID WASTES UNDER CURRENT TECHNOLOGY: ALAMEDA COUNTY, 1975

...ing ...t	Total Generation (Tons/Yr.)	Ferrous Metals (7.6%) Amount (Tons/Yr.)	Ferrous Metals (7.6%) Value $ Million	Nonferrous Metals (0.7%) Amount (Tons/Yr.)	Nonferrous Metals (0.7%) Value $ Million	Glass (6.4%) Amount (Tons/Yr.)	Glass (6.4%) Value $ Million	Newspaper (0.9%) Amount (Tons/Yr.)	Newspaper (0.9%) Value $ Million	Corrugated Cardboard (2.2%) Amount (Tons/Yr.)	Corrugated Cardboard (2.2%) Value $ Million	Total Recoverable (17.8%) Amount (Tons/Yr.)	Total Recoverable (17.8%) Val... $ M...
	544,500	20,700	$0.21	1,910	$0.57	17,400	$0.14	2,450	$0.02	5,990	$0.06	48,500	$1.00
	265,300	10,100	$0.10	930	$0.28	8,500	$0.07	1,190	$0.01	2,920	$0.03	23,600	$0.49
I	96,800	3,700	$0.04	340	$0.10	3,100	$0.02	440	$0.00	1,060	$0.01	8,600	$0.17
	176,800	6,700	$0.07	620	$0.19	5,700	$0.04	800	$0.01	1,940	$0.02	15,700	$0.33
Y	1,083,400	41,200	$0.41	3,790	$1.14	34,700	$0.27	4,880	$0.05	11,920	$0.12	96,400	$1.99

...rtion of San Ramon, Contra Costa County, is included in the LAVPU data.

Significantly lower estimated unit values are used in Table II-23 because of less pure output and possibly depressed prices due to over supply. The estimated unit values used are those developed by NCRR[1]: Ferrous metals @ $10/ton, nonferrous metals @ $300/ton, 5/8 of the glass @ $12/ton, 3/8 of the glass @ $1/ton and paper and corrugated @ $10/ton. The 5/8 portion of the glass is of larger size and color sorted, and the remaining 3/8 is undifferentiated fines.

Based on a total County generation of 1,083,400 tons of solid wastes per year and a total value of $1,990,000 for the recoverable materials (17.8 percent) each ton of solid waste has a materials value of $1.84.

There are several alternatives to the existing system of uncoordinated efforts to recover materials from solid wastes, and these alternatives will be discussed in detail in Section V, "Evaluation of Solid Waste Management Technology." A brief comparison of these alternatives with the existing system illustrates the potential in Alameda County for large-scale resource recovery at the County or regional level.

To meet the objectives of the Nejedly-Z'berg-Dills Solid Waste Management and Resource Recovery Act of 1972, the existing solid waste management system for mixed municipal wastes must expand to encompass some combination or aspect of the following processes: materials recovery processes, energy recovery processes, pyrolysis processes, chemical processes, heat recovery from incineration, and composting. Materials recovery processes are designed to remove paper, ferrous and nonferrous metals, and glass from the refuse. Energy recovery technology includes fuel recovery, steam generation, and electrical power generation. Pyrolysis processes recover synthetic fuel oil and gas. Chemical conversion processes (anaerobic digestion, acid hydrolysis, wet oxidation, hydrogennation, and photodegradation) produce such products as methane, alcohol, yeasts, oils, glucose sugar, proteins, and other organic chemicals. Unfortunately, most of these processes are in the development stage. Heat recovery from incinerators has significant technical problems. Composting is well established technologically, but the product has had poor marketability. However, composting could be used to reclaim marginal lands.

Several solid waste management systems--including various amounts of resource recovery--are under discussion and evaluation in Alameda County.

The Oakland Scavenger Company has issued a report describing a system of transfer stations and material recovery facilities. Front-end separation would separate 10 percent of the total input, primarily metals and glass. The remaining 90 percent could be channeled into an energy recovery or pyrolysis facility or long-hauled to a landfill disposal site.

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[1] National Center for Resource Recovery, Washington, DC

The proposed East Bay Energy and Resource Recovery System (EBERRS)[1] utilizes a pyrolysis process developed by the Union Carbide Corporation to convert solid waste and possibly sewage sludge into a synthetic gas or syngas. There are four alternative methods of syngas utilization: (1) conversion to methane, (2) direct delivery to customer, (3) generation of electric power, and (4) conversion to methanol or ammonia. The Pacific Gas and Electric Company could adopt any of the first three methods of syngas utilization. Conversion of syngas to methanol or ammonia would have to be accomplished by another company or agency. A minimum of 1,500 tons per day of shredded refuse (minus valuable metals and possibly glass) from the Central Metropolitan and Eden Planning Units would feed into the gasification process. It is possible that the East Bay Municipal Utility District could contribute 208 tons per day of digested sewage sludge (25 percent solids), but it would contribute little to the output. Schnitzer Steel Products of California has 90 tons per day of shredded combustible refuse available to feed into the plant. Thus, the proposed gasification plant presently under study could process at least 1,750 tons per day and possibly 2,100 tons per day by the time a plant could be ready for operation in 1978. The 1,500 tons contributed by Oakland Scavenger is about 34.8 percent of the daily tonnage being disposed at the present time in landfills (4,300 tons per day).

Another alternative to the existing solid waste management system in the Bay Delta Resource Recovery Demonstration Project. This project proposes a composting system utilizing organic wastes from the City of Berkeley at the rate of 200 tons per day (or 42,000 tons per year) to stabilize levees and agricultural land at Mandeville Island in the Bay Delta.

Figure II-2 illustrates a combination of all three alternatives when applied to solid wastes in the Central Metropolitan and Eden Planning Units in 1980. Total materials recovered is 12.9 percent of total wastes estimated at 78.2 percent of total wastes generated. Therefore, only about 8.9 percent of the total wastes is not recovered; it is either lost to the environment or disposed in a landfill site.

Thus, there is much potential for large-scale resource recovery in Alameda County, especially in the more urbanized areas. A comparison of costs between the existing system and the resource recovery alternatives is given in Section VI.

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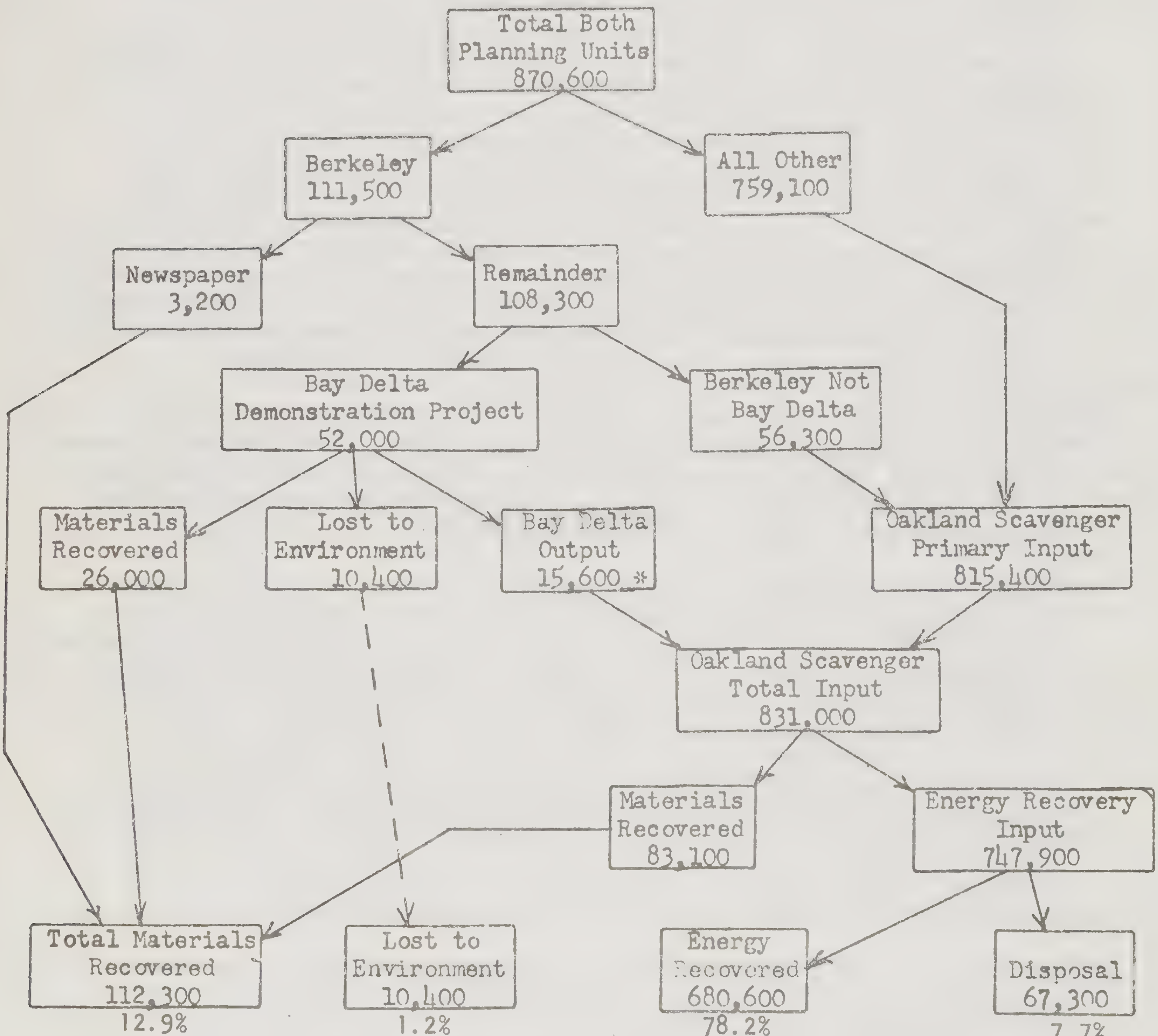
[1] Ralph M. Parsons Company, EBERRS, East Bay Energy and Resource Recovery System Feasibility Study Report (March, 1975).

Figure II-2

FLOW CHART OF SOLID WASTE FROM CMPU AND EPU THROUGH BAY DELTA DEMONSTRATION PROJECT, OAKLAND SCAVENGER COMPANY AND EBMUD/PG&E SYSTEMS: TONS/YEAR, 1980[1]



* This fraction has limited characteristics.

[1] Estimated by Alameda County Planning Department, October, 1974.

III. ENVIRONMENTAL CONSTRAINTS

A. Physiographic Description of Alameda County

Alameda County is located on the east side of southern San Francisco Bay. Within its boundaries is 735 miles of land and 77 square miles of bay. Elevations range from sea level along the 36 miles of bay shoreline to 3,817 feet in the foothills south of Livermore. The County is approximately thirty-two miles in length in a north-south direction and 45 miles in width in an east-west direction. The County is a diverse combination of land types and forms ranging from salt water marshes along the bay plain to moderately high uplands and intermontaine valleys. Thus, the climate varies from a marine type along the bay fringes to fog-shrouded Redwood forest in the East Bay Hills, to arid range sites of open grassland savannah in the portion of the County adjacent to the San Joaquin Valley. Conditions vary depending upon the mean sea level, altitude, and the topography, as well as the distance from the ocean and bay.

The Bay Plain varies from three miles in width at the north end of the County, in the Berkeley-Albany area, to eight miles at the south, near Fremont. The bay plain is composed of geologically recent fluvial and alluvial deposits of the late Cenozoic period. In this portion of the County is located the major portion of the high density urbanization which comprises the urban core of the Eden and Central Metropolitan Planning Units. The southerly and less densely populated part of the bay plain still retains much of the rural character of the past, although this is rapidly disappearing around the cities of Fremont, Newark, and Union City. In the South Bay vicinity are tidal flats and marshes, salt ponds, the Alameda Creek-Coyote Hills Regional Park, and portions of the South San Francisco Bay National Wildlife Refuge Complex.

East of the Bay Plain are the East Bay Hills which are a part of the western and central portion of the Diablo Range. The County extends east through the Diablo Range to the western edge of the San Joaquin Valley. Within this area is located the Livermore and Amador Valleys, which are the largest of the intermontaine valleys in the coastal range. The eastern portion of the County varies from gently rolling terraces and alluvial plains to the steep to very steep V-shaped upland areas Well used and possibly historic trade routes, now permanent interstate freeways, exist through natural passes located east of Hayward, through Dublin Canyon, through Niles Canyon, and through Mission Pass in the Mission Hills east of Fremont. The highest points in the East Bay Hills are Monument Peak, 2,594 feet, and Mission Peak, 2,517 feet, both east of Fremont. The East Bay ridge provides a dramatic background for San Francisco Bay and the coastal plain on the west slopes and a scenic background on the east slopes for the Livermore-Amador Valley. The large intermontaine coastal valley, the Livermore and Amador Valley, is separated from the bay plain by eight miles of foothills in the north, east of Castro Valley, and about four miles in the Mission Pass area.

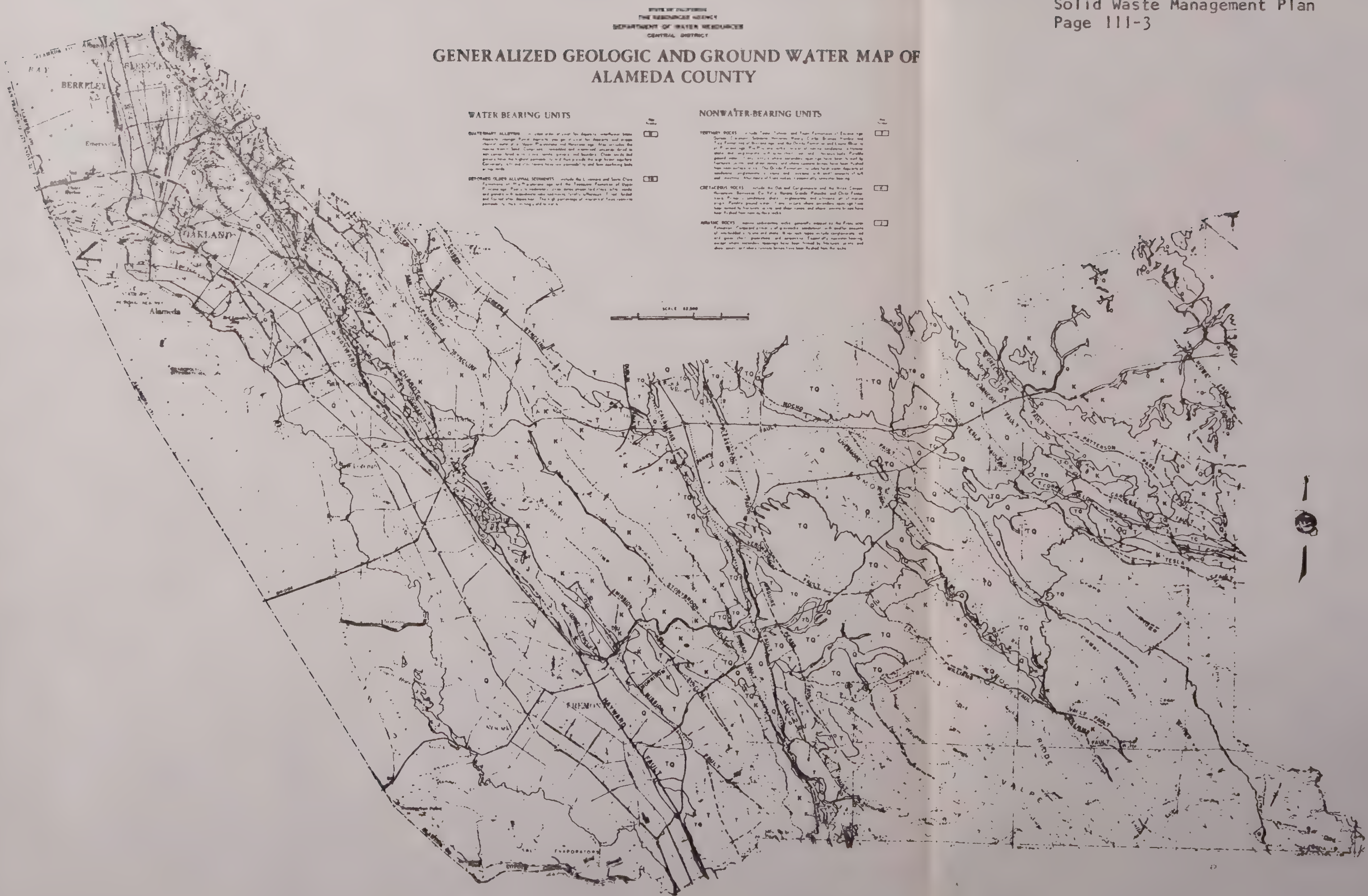
Major ridgelines and peaks (East Bay Ridge, Mount Diablo, Mount Hamilton, and Arroyo del Valle) separates the County into three significant hydrologic units and two areas of minor hydrologic significance. All hydrologic units are extremely important when considering various aspects of water resources management. The hills surrounding the Livermore and Amador Valleys are predominantly open primarily devoted to agriculture or some form of recreation. In the extreme northeastern corner of the County, a small flat area extends into the San Joaquin Valley. Some of this area is devoted to agricultural crop production; the foothill portion is similar to the grasslands of the Altamont vicinity and the Great Valley Foothills.

Approximately fifty-six percent of the County contains hills with a slope of twenty-five percent or greater. The distribution of the area of 25 percent or greater slope is 34 percent in the western portion of the County and 72 percent in the eastern portion. With the exception of residential development in the Oakland and Berkeley hills, small developed portions in the Hayward hills, and minor development in the Pleasanton area, the major portion of the East Bay Ridge and Diablo Range in Alameda County remains undeveloped. Most of the undeveloped East Bay Ridge area is shown in open area on the County General Plan; and all the ridges on the north, east, south, and west sides of the Livermore-Amador Valley are undeveloped and shown as open space on the County General Plan. Much of the open use is presently utilized for some form of agriculture, depending on soil fertility, capability, and type.

Central Metropolitan Planning Unit

The Central Metropolitan Planning Unit consists of the cities of Alameda, Albany, Berkeley, Emeryville, Oakland, and Piedmont. In the 1968 Estimate of Existing Land Use, approximately ninety percent of the 52,900 acres in the planning unit were developed and in residential, commercial, industrial, public or semi-public, or vacant uses. All of the land area in the CMPU is incorporated; approximately 5,280 acres are in major parks and recreation uses, and 4,920 acres are vacant urban. The cities occupy the area from the crest of the East Bay Hills to the bayfront, from Albany to the northern limit of San Leandro, in a wide variety of densities and land uses. Approximately fifty-five to sixty percent of the population and industrial activity in the County is located in the CMPU.

One of the major problems associated with waste disposal in the CMPU is that the higher densities of population tend to concentrate the generation of waste. Today, this has resulted in the filling of most available landfill sites in the western portion of the County. Other limitations by ordinance or decree have left the CMPU with less than three years of landfill capacity. In addition, the aggregation of population and industry in this planning unit has effectively eliminated the possibility of locating new landfill sites within the CMPU.


DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
GENERALIZED GEOLOGIC AND GROUND WATER MAP OF
ALAMEDA COUNTY
WATER BEARING UNITS
NONWATER-BEARING UNITS
BERKELEY
OAKLAND
Alameda
FREMONT
HAYWARD
FAULT

Existing sites in the CMPU include the Albany Landfill which reportedly receives general rubbish and demolition materials, the Berkeley Landfill which serves the municipal collection system for the City of Berkeley and general weekend haulers, and the Alameda City Dump which has outlived its capacity by nearly two years and serves the City of Alameda. Refuse from the City of Oakland is hauled to the Davis Street Site which is located in the Eden Planning Unit and will be discussed below.

Eden Planning Unit

Included in this planning unit are the cities of San Leandro and Hayward and the unincorporated communities of San Lorenzo and Castro Valley. The Eden Planning Unit consists of a total of 77,630 acres of which 27,890 acres are incorporated and 49,740 are unincorporated. Over 39,000 acres of this area are uncultivated and undeveloped; however, within this uncultivated area there are many constraints which would preclude development as a landfill site. As described previously, the EPU occupies an area between the East Bay Hills and the San Francisco Bay. Most of the development is along the bay plain and is concentrated in the cities mentioned above. The southern portions of the eastern boundary of the planning unit is Sunol Ridge.

In January, 1975, there were three landfills operating within the EPU. Within a very short time (by Nov./Dec., 1976), the site at the San Leandro Marina will close to prepare for final grading as a golf course. The site at the end of West Winton Avenue closed in November, 1974. Approval has been obtained by the operator to build a temporary transfer station at this location. Transfer of solid wastes collected in the southern portion of the EPU will be short-hauled from collection routes to the West Winton transfer station and then hauled to the disposal site at Davis Street in San Leandro. The site at Davis Street serves the major portion of the Eden and Central Metropolitan Planning Units and has an estimated remaining capacity of two to two and one-half years for the waste from these two planning units.

Washington Planning Unit

The Washington Planning Unit begins south of Hayward and includes the cities of Fremont, Newark, and Union City; the unincorporated area to the west; and a Rural-Recreation Area to the east in the foothills. The 1968 land use survey showed 93 percent of the 77,720 acres in this planning area incorporated into one of the three cities. In the same survey, 49,380 acres were designated as in agricultural uses, while 28,340 acres were assigned to residential, commercial, and industrial or governmental uses. As in the other areas to the north in the County, the predominant area of urbanization in this planning unit is the bay plain between the foothills and the bay. Unique to this area is the Alameda Creek-Coyote Hills Regional Park near the edge of the bay and the adjacent South San Francisco Bay National Wildlife Refuge to the south.

There are two disposal sites within this planning area which serve the residents of Fremont, Newark, and Union City. The Turk Island Disposal Site is operated as a general refuse landfill or dump and accepts refuse hauled in by the general public. The collection of household, commercial, and industrial refuse within the Planning Unit is done by a subsidiary of Oakland Scavenger Company. The collected refuse is dumped at the Fremont Site on Durham Road. Capacities of these sites are estimated at about twenty-five years at the present rate of filling. Stipulations in the franchise contracts with Oakland Scavenger Company prevent the disposal of wastes from outside the incorporated area of the three cities in the planning unit.

One characteristic shared by the portion of Alameda County west of the East Bay Hills is the location of the landfills on, or in or very near, the bay. Although this practice has been sanctioned in the past, the development of technology and the awareness of the problems associated with refuse decomposition should be enough warning to watch past and future practices with care. In most instances, the disposal sites are located over bay muds in the marshland or even tidelands (present or past) where the potential for ground water contamination is dangerously high. Some of the landfilling operations make a point of excavating some of the surficial material before covering, which brings the refuse in even closer proximity to the ground water. Past errors of convenience in locating disposal sites will occur less frequently as a result of comprehensive solid waste management planning.

Livermore-Amador Planning Unit

The Livermore-Amador Planning Unit (LAPU) consists of 267,470 acres and represents nearly 59 percent of the land area in Alameda County. About six percent, or 14,620 acres, is incorporated into the Cities of Livermore or Pleasanton. The boundaries of the LAPU are defined by the County line near Bethany Reservoir to the north and Mt. Boardman to the south, and by Monument Peak to the west and Dublin to the County line at the northwest. The area stretches from the East Bay Hills (Sunol and Pleasanton Ridges) to the Eastern Units of the Diablo Range western edge of the San Joaquin Valley.

Topography within the LAPU is quite varied and ranges from gently sloping lowlands to very steep canyons. Approximately seventy-two percent of the area has a slope of 25 percent or greater. Land-type divisions may be made based upon topography into at least three categories: upland site, terrace sites, or valley or lowland sites. The location of the boundary of each unit is different depending upon the basic information used in the interpretation. Basically, however, the LAPU consists of the northern section of the Diablo Range surrounding the Livermore, Amador, and Sunol Valleys.

B. Generalized Geology of Alameda County

1. Geology of the Western Portion of Alameda County

The part of Alameda County which lies west of the Calaveras Fault includes the East Bay Hills from Albany on the north to the Mission District east of Fremont. Also included in this area is the bay plain from the base of the foothills to the edge of San Francisco Bay. The rocks in the hills are older and considerably more complex than the relatively recent alluvial deposits of the bay plain. The complexity of the rocks in the hills is a function of their diversity of type and characteristics. For example, in the Berkeley-Albany hills, the following formations have been identified: Mesozoic ultrabasic intrusive rocks, Franciscan, Eocene marine, Pliocene volcanic, middle and/or lower Pliocene nonmarine, and Pleistocene nonmarine. As one progresses south in the hills from Oakland to Fremont, the predominant formation is upper Cretaceous marine with strips of ultrabasic intrusive rocks (Mesozoic), Pliocene volcanic, and middle and/or lower Pliocene nonmarine along the western base of the hills.

The plain west of the foothills in Alameda County is Quaternary Alluvium deposits of recent origin which have washed down from the hills and settled on top of the older rock formations. One may visualize the process of formation of this plain as a progressive accumulation of layers of materials of varying permeability. Some of the layers which have been identified in the Quaternary alluvial deposits have come directly from the hills and some are a result of sedimentation of clays and muds while the area was partially or wholly submerged. The most important factor in this formation is that, because of the varying permeability from layer to layer, ground water is in the aquifers. This layering has occurred in such a fashion around the creeks pouring into the bay that humps, or cones, have formed at San Leandro, San Lorenzo, and Alameda Creek. These cones which are presently sources of ground water for residential and agricultural uses are called the San Leandro, San Lorenzo, and Niles Cones, respectively.

Along the very western edge of the bay plain, the geologic formations do not alter appreciably from that mentioned in the previous paragraph, but the combined importance of the geologic, biologic, and man-interference with the bay and tidelands has resulted in both an interesting and sensitive environmental area. The historic marshes are undergoing a change to the characteristic plain, which is observed further inland. Indian shell mounds which were once located on the shores of the bay several centuries ago are now several miles from the shore. All of the landfill sites in the western part of Alameda County are located in this fringe area. Geologically, this area does not allow the adequate separation or isolation of decomposition materials from the underlying soils and rocks; and the potential for degradation of already deteriorating environmental conditions is high.

2. Geology of Livermore-Amador Planning Unit

The LAPU is located in the northwest-trending coastal range. There are several unique features about the area. The upland sites which surround the valley are composed of geologically older consolidated nonwater-bearing rock formations. This material also forms the foundation of the Livermore Valley at considerable depths. In the uplands area south of Livermore, the Franciscan Formation may be observed. With few exceptions, this is the oldest formation, which constitutes a major portion of the uplands in this area. The Franciscan Formation is described as "graywacke, locally abundant red & green thin-bedded dirt, siltstone & silty shale, minor conglomerate, limestone, blue-gray glaucophane-bearing schist & related metamorphic rocks. The Franciscan Formation in the Diablo Range is generally considered to be of Jurassic & possibly pre-Jurassic age."[1]

In the upland areas around the Patterson Pass and the Carnegie Fault, a division occurs between the Franciscan and the Del Valle Formations. This area stretches between Corral Hollow and Interstate 580 and is a mixture jumble of upper Cretaceous marine, upper Miocene marine, and middle and/or lower Pliocene non-marine sedimentary and meta sedimentary rock. From I-580 north to the base of Mt. Diablo is a large block of upper Cretaceous marine sedimentary rock. This formation is prevalent, too, in the Hayward Hills between I-580 and Niles Canyon. Again in the uplands areas between Niles Canyon and Monument Peak, the Cretaceous and Miocene marine and middle and lower Pliocene non-marine formation units are found interspersed with each other.

Upland formations primarily consist of marine sedimentary and meta sedimentary rocks. Only small amounts of igneous rock is apparent in the uplands. Examples of the Meroziog ultra basic intrusive rock may be observed in the uplands near the southern end of Del Valle Reservoir.

The Livermore Valley was formed by an east to west downfold along the Calaveras Fault. The alluvial terraces and plains, recognizable as the mid-level elevations or rolling foothills north and south of Livermore, constitute the second broad physiographic division. This transition zone is divided into two areas based upon geologic units: the foothills north of Livermore on the south slopes of Mt. Diablo, and in the prominent foothills along Doolan, Collier, and Tassajara Creeks north of Livermore and Arroyo Las Positas in a formation of middle and/or lower Pliocene non-marine sedimentary rocks identified as the Orinda and Neroly Formations.

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[1] "Stratigraphic Nomenclatur-San Jose Sheet" in Explanatory Data San Jose Sheet, Geologic Map of Calif., Calif. State Department of Conservation, Division of Mines & Geology, Olaf P. Jenkins Edition, 2nd Printing, 1972 Cedar Mountain, and along the portions of Cedar Ridge, Main Ridge, and Apperson Ridge.

The Orinda Formation has been subdivided into the Tassajara and Green Valley Formations and is characterized by "red, gray, or brown, loosely consolidated sandstone and conglomerate, subordinate amounts of shale, claystone, limestone lenses, and tuffaceous bentonitic clay."[1] The Tassajara Formation, more appropriately associated with this area, consists of brown to gray mudstone, andesitic sandstone, conglomerate, and minor bentonitic and pumiceous tuff."[1] The Orinda is basically a continental flood plain deposit with discontinuous marine beds at the base.[2]

South of Livermore and Pleasanton, the low foothills consist of Plio-Pleistolene non-marine sedimentary deposits of the Livermore gravel formation. The Livermore gravel is characterized by "loosely consolidated sand, gravel, clay, and local tuff beds (contains Pliocene fresh water invertebrate fauna and Pleistocene vertebrate fauna)."[3]

The lowlands of the Livermore Valley consist of recent alluvial deposits with minor intrusion of the Orinda and Livermore Formations. It is in the explanation of the alluvial deposits that the entire Planning unit assumes its character as a complex system. The entire LAPU may be visualized as an impervious bowl partially filled with alternating layers of gravel and clay. As mentioned above, the Franciscan and Del Valle formations are largely nonwater-bearing in native while the Orinda, Neroly, Livermore, and Recent Alluvial deposits all contain water in the primary openings between the particles. In these water-bearing formations, particles vary in size from less than one-tenth of an inch to feet or yards.

In the lowland and terrace formations, the hydrologic importance of the system renders the entire Livermore Valley a valuable natural resource. Water-bearing rock yields water in sufficient quantities to supply domestic, industrial, or agricultural needs. While both the Livermore Formation and the Recent Alluvial deposits contain water, the Livermore is somewhat more constrained in its ability to transmit water because of the high percentage of fine-grained materials between the larger gravel.[4] These interstitials particles restrict the movement of water. Recent alluvial deposits, more loosely consolidated, allow for a greater movement and cycling of water from the surface.

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[1] "Stratigraphic Nomenclatur-San Jose Sheet" in Explanatory Data San Jose Sheet, Geologic Map of Calif., Calif. State Department of Conservation, Division of Mines & Geology, Olaf P. Jenkins Edition, 2nd Printing, 1972 Cedar Mountain, and along the portions of Cedar Ridge, Main Ridge, and Apperson Ridge.

[2] Geologic Guidebook of the San Francisco Bay Counties Bulletin 154, Calif. Division of Mines & Geology, 1951 (p. 143).

[3] Stratigraphic Nomenclatur-San Jose Sheet.

[4] Livermore and Sunol Valleys - Evaluation of Ground Water Resources - Appendix A: Geology, Bulletin 118-2, Calif. State Department of Water Resources.

Within the LAPU, at least 17 faults have been identified. As mentioned above, the Livermore Valley has developed in an east-west dipping downfold or syncline terminating with the Calaveras Fault and the uplifted Pleasanton Ridge block. At the base of the Altamont Hills is the Greenville Fault which terminates near Arroyo Las Positas. In the southern section of the Altamont Foothills, the Patterson Pass, Tesla, Carnegie, and Corral Hollow Faults are found. These faults run parallel to each other between the Livermore and the San Joaquin Valleys. East of Altamont Pass near Grant Line Road is the Midway Fault which is located in a local depression along Grant Line Road.

The faults found in the upland hills between Tesla Creek and the Mission Hills (Monument Peak) are the Valle, Williams, Verona, Indian Creek, Mayuire Peaks, Welch, and Calaveras. Among these, the Calaveras and Verona-Williams-Valle Systems appear to be the most prominent.

Within the Lowlands of the Livermore Valley, several faults have been identified; they are the Livermore Fault and its branch, the Parks Fault, the Pleasanton Fault and its branches, and the northern section of the Calaveras-Sunol Fault. In the vicinity of Dublin, the Gravel Pit and the Dublin Faults are observed in the foothills.

3. Slope

The greater portion of the Livermore-Amador Planning Unit is in the greater than 30 percent slope category. In the valley lowlands, much of the land is level with from zero to five percent slope. The fringes of the foothills around the entire Livermore and Amador Valleys consist of 5-15 percent slope.

In the foothills north of Livermore around Doolan and Collier Canyon and in the Altamont hills, the slopes are gentle, rarely exceeding 30 percent and generally falling within the 15-30 percent range.

South of Livermore and Pleasanton, the Upland areas of the Diablo Range consist of a high proportion of 30-50 percent slope hills. Some marines range to nearly 70 percent slope. Within the upland areas, there are plateaus and canyons which fall into the 5-15 and 15-30 percent ranges; but these areas are minimal.

Although slope considerations, alone, may severely limit development and are of a site, interpretation of the degree of constraint is included in the Soils Resources discussion, since interpretation of slope is included as part of the Soil Survey.[1]

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[1]USDA, Soil Conservation Service, <u>Soil Survey: Alameda Area, California</u>, March, 1966.

C. Soil Resources

Soil is a resource that changes tremendously from area to area. It is subject to relatively few physical and chemical forces which cause the widespread variations. Soil formation is a dynamic process of chemical and physical interaction known as weathering. Physical changes brought about by the action of water, wind, ice, and gravity contribute to the weathering of parent materials; and the formation of soil alter the conditions depending upon their presence or absence. These four physical factors acting together with several chemical factors cause soil to develop. Chemical factors such as solubility of the parent materials and the leaching out of these materials by the water oxidation of substances, hydration, carbonation, and the decomposition of organic materials are the significant chemical processes of soil development.

Soil development consists of stratification of soil particles and other organic matter into profiles of horizons (layers) by the processes of solution and percolation. Differentiation must be made between the soil-forming processes and geologic processes which occur simultaneously and disrupt or alter the even formation of soil; such as earthflows, debris slides, slumps, and rockfall, erosion, and deposition or sedimentation that do alter the local (formation of) soil profiles but which do not constitute the processes involved in formation of soil types of difference. Soil texture and structure are determined by the particle size and configuration which, in turn, determine the degree to which the solution and percolation of materials will occur. Soils are either formed in place, and thus sedentary, or are transported by wind or water.

Physical development of soils shows regional variations depending upon environmental factors such as the hydrologic, photosynthetic, biogeochemical, and cycles. Just as variations in climate affect the plant and animal life found in an area, it also affects the development of soil profiles. The eastern half of the United States have what is known as predominantly pedalfic soils, while western prairie/grasslands have what is known as pedocal soils. These terms refer to the absence or presence of a hard carbonate layer in the deper horizons of the soil; the layer is more common to the less acidic soils of the prairie states, thus pedocal. Profile development may be divided into three different, and regionally distinct, processes generally related to climate: podsolization, lateriation, and calcification. Podsolization occurs in cold and wet climates, laterization in warm or hot and wet climates, and calcification in regions of low to even rainfall distribution throughout the year with temperatures which cause high rates of evaporation. Alameda County falls in an area with a climate which sustains uneven rainfall distribution and high evaporation of water, which is the latter category.

The focus of the Alameda County Soil Survey of 1966[1] was on land that was least urbanized and had high or potentially high agricultural productivity. For this reason, the areas west of the Hayward and Fremont Hills have just been mapped, as are some of the metropolitan areas in the north-western portion of the County. The soil survey was intended for agricultural use; but recently it was recognized that the wide range of information derived from the Survey was indispensible for land management, land use, and environmental analyses. Thus, the survey is being revised and expanded to include areas in the western part of the County. Contained within the Survey is a wealth of information about the soils, ranging from physical soil types to engineering properties to conservation and management needs and policies.

The Soil Survey presents a vast array of information to us depending upon the interest we have and the need we wish to fulfill. Initially, the seven major soil associations that are found in the County are described. Soil associations are the identified patterns that the soils fall into. In the Survey, three associations are identified as Upland Soils and four as Terraces, Alluvial, and Flood Plain Soils.

TABLE III-1. Alameda County Soil Associations[1]

Soils of the Uplands

1) Altamont-Diablo association: Moderately steep and very steep, brownish and dark gray, moderately steep soils on soft sedimentary rocks.

2) Vallecitos-Parrish association: Moderately steep and very steep, brownish and reddish-brown soils on metasedimentary and basic igneous rocks.

3) Millsholm-Los Gatos-Los Osos association: Moderately sloping to very steep, brownish soils on moderately hard sedimentary rocks.

Soils of the Terraces, Alluvial Fans, and Flood Plains

4) Yolo-Pleasanton association: Nearly level to sloping, grayish-brown very deep soils on flood plains and low terraces.

5) Positas-Perkins association: Nearly level to very steep, brown, shallow to moderately deep soils on high terraces.

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[1]USDA, Soil Conservation Service, Soil Survey: Alameda Area, California, March, 1966.

TABLE III-1. Alameda County Soil Associations (Cont.)

6) Clear Lake-Sunnyvale association: Nearly level to sloping, dark-gray very deep, well-drained to imperfectly drained soils on flood plain sand.

7) Rincon-San Ysidro association: Nearly level, shallow to very deep, pale brown and grayish-brown soils on older fans and flood plains.

Agricultural and Soil Resources Management Policy Recommendations

1. Capability for Agricultural Production-Soils are grouped by their capability or suitability for raising most kinds of crops. The grouping is a practical one, based upon the "limitations of the soils, the risk of damage when they are used, and the way they respond to treatment."[1] There are eight major Capability groups, and within the area surveyed, four subclasses that indicate one or another major limiting factors within the Capability Class. In addition there are ten capability unit categories which relate to the crop suitability and management practice necessary to conserve productivity. The capability unit relates to a specific limitation that a class of soil would have and the need for appropriate conservation measures.

   In addition to the capability management factors that relate to the local physical factors of each soil association, there is also a classification of the soil groups on the basis of environmental factors and the potential which a range site has to produce a given crop of forage or vegetation.[2]

   This more ecological system groups the range sites according to environmental factors such as topography, drainage, rainfall, current and potential vegetation, and evapotranspiration, as well as exposure to the sun (insolation). This system will be more completely discussed in terms of specific classification and management factors in the section on Vegetation and Wildlife Fisheries Resources.

D. Vegetation and Biotic Communities

1. Classification of Natural Communities - Shoreline Area

   The western portion of Alameda County consists of an urban corridor running between Berkeley and Fremont with a narrow fringe of marshlands along the Bay and considerable open space in the East Bay Hills. Of the 208,250 acres in the Central Metropolitan, Eden, and Washington

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[1] USDA, Soil Conservation Service, Soil Survey: Alameda Area, California, March, 1966.

[2] This is known as the "Range Site Potential" which is being developed by the USDA, Soil Conservation Service.

Planning Units, approximately 80,600 acres would fall into the land use categories of uncultivated/undeveloped or major parks and recreation. Conditions in the East Bay Hills are similar to that found in the lowland hills in the Livermore Valley. The plant-animal-human interference patterns will be discussed. Numerous Environmental Impact Reports prepared by cities and the County on projects located in the Hills describe localized environmental settings. Also of great utility and importance is the report done for the City of Hayward, the Hayward Hill Study[1] This report contains detailed discussions of all natural physical-biological conditions unique to the Hill Area in Alameda County.

Less often mentioned, but more in need of reduction of all forms of pressure from human interference (through coordinated planning), is the narrow and fragile Bay marshland lying between San Leandro and Fremont.

The remnants of what was once an undisturbed system of marshes and estuaries provides the diversity of habitat necessary to support many species of aquatic and terrestrial animals. The extensive salt evaporation ponds have provided a unique and sensitive habitat. The abundance of animal life in this rich habitat is a continuing proof of the health and vitality of the area.

Historically, most of the shoreline area was subject to tidal action, either as mudflats or salt marsh. The remainder were uplands probably covered with grassland or brush. Old accounts tell of abundant marine life in the Bay, including sea otters and salmon. The present land use is dominated by man's activities; the marine life is vulnerable to man's pollution of the Bay.[2]

Most of the original salt marsh has been diked off from tidal action and thus destroyed. In the portion north of the San Mateo Bridge, the diked areas are mainly dry and are used for sanitary landfill and grazing. In the portion south of the San Mateo Bridge, most of the diked land is in salt ponds.[2]

The shoreline environment or ecosystem (involving the interrelationship of organisms and environment) consists of many parts: open water in the Bay; mudflats exposed at low tides; shoreward stands of cordgrass; and landward, pickleweed. The vegetation serves as the broad food base for marsh and bay animals, and as habitat for many species.[2]

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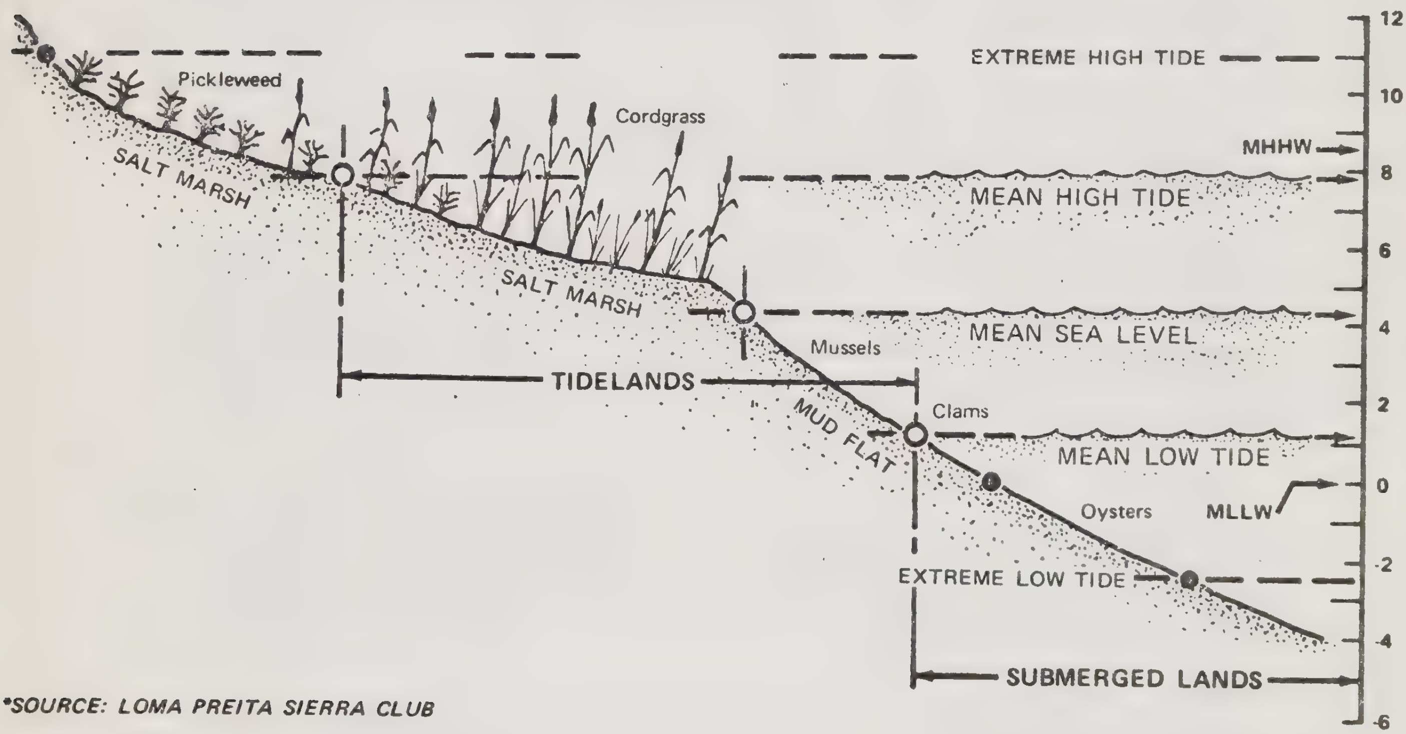
[1] Hayward Planning Department, Hayward Hill Area Study, April, 1971.

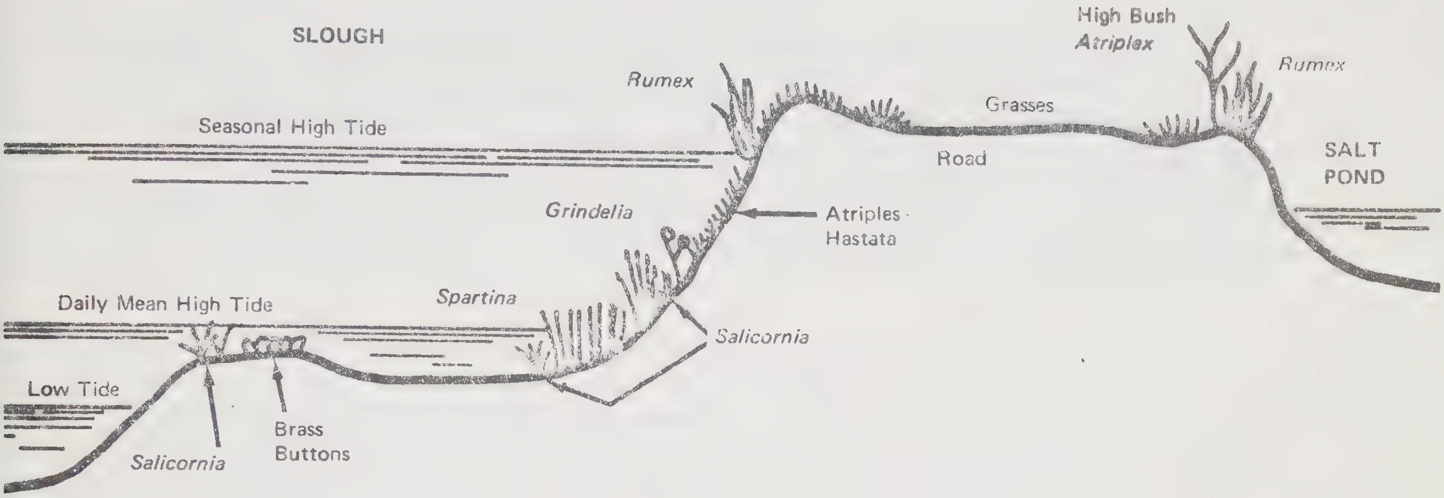
[2] Excerpted from Hayward Shoreline Environmental Analysis, entitled "Ecology" by John Werminski. A complete text is included in the background report "Environmental Constraints for Solid Waste Management."

Six different ecosystems have been recognized in the Shoreline Area: Shallow Bay Water, Tidal Mudflats, Salt Marsh, Salt Ponds and Dikes, Minor Miscellaneous Habitats (dry dikes areas and seasonal fresh water ponds, and upland habitats: fields and pastures, isolated hills, and residential-industrial areas).[1]



[1] Excerpted from Hayward Shoreline Environmental Analysis entitled "Ecology" by John Werminski. A complete text is included in the background report "Environmental Constraints for Solid Waste Management

TYPICAL SLOUGH – SALT POND LEVEE CROSS SECTION*



SOURCE: ADAPTED FROM TUDOR – 1972

MINOR MISCELLANEOUS HABITATS

Limited acreages of two other habitat types occur in the planning area: diked dry areas and freshwater ponds. Because they play relatively minor roles in the overall ecological picture, they will be treated briefly here.

Dry Diked Areas and Dumps

About 1,700 acres of planning area terrain are presently diked off and relatively dry. Since some of this area is composed of previous salt ponds, relatively high salinity can be a limiting environmental factor. For this reason and because of their aridity, Harvey (1973) considers these areas to be particularly low in ecological value since they lack much life; but he notes that, like low-value salt ponds, they serve as open-space areas that do not contribute greatly to air pollution and do not restrict air movement - thus are ecologically more valuable in their present state than they would be if urbanized.

Of some interest is the dump at the end of West Winton Avenue, which belongs to this general habitat type. As a rule, sanitary fills tend to smell bad and are unsightly; in addition, rainfall-leaching (and flood-leaching) in dump areas can result in seepage of polluted water and contamination of the environment. Despite these detrimental impacts, however, considerable wildlife may be attracted to disposal sites. While sanitary fills are never balanced ecosystems - vegetation cannot find a foothold in an active site - the fill does contribute a supporting food niche to adjacent habitats. In particular, hordes of gulls are commonplace - up to 13,000 of these birds have been reported in winter at the Winton Avenue site.

Seasonal Freshwater Ponds and Related Habitats

Limited amounts of shallow freshwater habitat are present in the planning area, the exact acreage varying with the time of year. This important, non-saline aquatic element is provided primarily by gun club ponds, the oxidation ponds of the sewage treatment plant, and winter floodplain accumulations. Freshwater habitats in general - ponds, marshes, or others - often contain a variety of green plants which, in turn, support a diverse pyramid of life, from aquatic micro-organisms to the larger, more conspicuous forms.

"Upland" Areas

In addition to its other major habitats, the Hayward shoreline planning area contains over two thousand acres of land which have been collectively termed "upland" terrain. These uplands occupy an irregular strip along the northeastern boundary of the planning area behind the mudflats, salt marshes and salt ponds; essentially they are part of the extensive "bay plain" region upon which San Lorenzo, Hayward, and Alvarado have been built. They include land now in residential or industrial use and also grassy or weedy land which now lies fallow. Much of the area is underlain by a substratum which is too high -- in some cases only by a matter of a few feet -- for tide flooding. While parts of it may be flooded by winter rains, the land is comparatively dry. Salt or brackish water often lies only a short distance below ground level, so that deep-rooted plants do not grow well. Prolonged exposure to sun and wind are other limiting physical elements of the fallow upland habitat. In terms of component vegetation, the open upland areas closely resemble the dikes, except that many of the native salt-tolerant species may be absent. As on the dikes, several important non-native grass species are joined by a diverse group of other non-native herbaceous plants, resulting in a "weedy" groundcover that extends beyond the fields and pastures to re-invade the fringes of adjacent developed areas.

Fields and other undeveloped upland areas are capable of providing habitat for an interesting variety of animals. A wide variety of insects and some reptiles are found here. A large proportion of the planning area's "land bird" species are associated with relatively undeveloped upland habitats, and a number of water birds sometimes find their way into the area as well. In the uplands, as elsewhere, an interlocking web of life binds many of these forms together.

Isolated Hills

Near the southern boundary of the planning area a pair of small hills rise conspicuously above the bay plain. Physiographically, these are a northern extension of the Coyote Hills, and the most prominent of the two, known as Turk Island, attains a maximum elevation of only 116 feet above sea level. Even so, this difference in height, slope, and substrata--and perhaps in human land use--is sufficient to produce a marked change in the vegetation of these areas and to permit many wildflowers and other plants to flourish on these low hills that may be absent or uncommon elsewhere in the planning area.

For the most part, the plants of these hills are quite typical of grasslands throughout the coast ranges of central California and are therefore not actually rare or endangered species. But, in the larger sense, the isolated nature of the hills places them in an ecological situation which--in its undeveloped state--is quite uncommon along the shore of San Francisco Bay. Well over forty different kinds of plants are found on or at the foot of the hills. In a vegetational sense, then, the hills should be ranked among the richest and most diverse of habitats to be found in the planning area.

D. Vegetation and Biotic Communities (Continued):

2. Biotic Resources of Livermore-Amador Planning Unit

a. Introduction:

Approximately ten thousand acres of the Livermore-Amador Planning Unit is developed in urban uses. The remaining 257,470 acres are in various agricultural uses. Valley lowlands and some of the rolling foothills around the lowlands are intensively cultivated for field and row or fruit crops. Upland areas are extensively farmed for cattle grazing or left in open space because of limitations inherent. The upland areas provide suitable habitats for many species of plants and animals in Alameda County. This section will discuss the biotic resources in Alameda County and specifically the biotic resources in the Livermore-Amador Planning Unit. The preservation of natural resources in the Livermore-Amador Planning Unit. The preservation of natural resources begins with an understanding of the composition of natural communities and how those communities are classified. The discussion will define the common natural communities found in the Livermore area. Resource conservation objectives will be presented to reflect the important areas in which policy should be developed.

b. Classification of Natural Communities - Inland Areas:

The mapping of all natural communities in any area would result in a map showing a mosaic of associations of various indigenous plants and animals. The distribution of plants and animals is determined by a variety of physical environmental factors. Conditions such as moisture, temperature, humidity, rainfall, evaporation, slope, geology, and soils, to mention a few, are all variables affecting plant and animal populations. Distribution of plants and animals is also determined by social factors. Adaptation, feeding or nutrient requirements, range, cover, food chains, and discrete inter-species activity will affect the composition of associations. Convenient systems of classification of natural communities based upon the frequently observed association of plant and animal species have been developed and documented. One system, developed by A. C. Smith, divided natural communities found in Alameda County into freshwater marsh, grassland, riparian (stream), woodland, broad leaf evergreen forest, oak woodland, and chaparral (brushland). Other systems of classification exist which describe the association or consociation of plants and animals based upon individual size and distribution, physical habitat, or functional attributes of the species; but for the ease of understanding in this presentation, the system devised by Smith will be used.

It should be mentioned early that human interference plays a very important role in the evolution and adaptation of plant and animal associations. In many instances, the extensive or intensive use of the land by man arrests or changes the natural species inter-action significantly. Introduction of exotic species by early settlers has resulted in their out-competing the native species. Land development and its impact on the surrounding ecosystems is also not an insignificant agent of change and interruption.

When assessing the ecological status of the communities exhibited in the County, a number of principles must be kept in mind. Smith bases his breakdown on the dominant or indicator species present in the community. Dominant species are commonly thought to control the nature and functioning of the entire community.[1] Dominant species may represent a climax or subclimax condition of vegetation development. Ecosystem development occurs in a series of stages or successions which is reflected in the changing structure of the community in time. Stages in the succession leading to a stable condition known as a climax community may occur as an orderly process of change. Changing physical factors which result from the growth and development of community diversity cause the disequilibrium which causes the succession to occur.

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[1] See Odum, E. P., Fundamentals of Ecology, Third Edition, 1971, Saunders, Philadelphia.

Climatic climax communities are highly diversified yet organized associations of plants and animals which are in equilibrium with the climate. A climax community is a terminal community.

The biotic communities described in Alameda County herein have undergone direct manipulation by man for several centuries. The direct interaction between man and nature usually arrests the process of natural succession to a climax community; what we see today in many areas are subclimax communities. The best example of this is intensive and extensive agriculture in many lowland sections of the Livermore-Amador Planning Unit.

There are eight different biotic communities in Alameda County as identified by Smith. The lowlands of the Livermore Valley are dominated by urban and rural communities and on the fringe give way to grassland; riparian woodland and freshwater marsh communities may be found at various spots along the major drainages in the Valley.

TABLE III-2. Lowland Biotic Communities of Livermore Valley

I.	Urban	Cities, towns, subdivisions, parks, etc.	Introduced trees and shrubs; House Finch, English Sparrow, Norway Rat, House Mouse, Cockroach.
II.	Rural	Cultivated crop lands and pasture.	All varieties of truck and row crops, fruit crops; Barn Owl, Sparrow Hawk, Brewers' Blackbird, Gopher, Vole, Gopher Snake, Alfalfa, Cabbage Butterfly.
III.	Riparian Woodland	In wooded canyons along stream courses.	Western Sycamore, Fremont Cottonwood, Red Willow, Arroyo Willow, Big Leaf Maple; see appendix for faunal indicator species.
IV.	Grassland	Non-cultivated areas in Livermore Valley and adjacent hills.	Blue Bunch Grass, Calif. Oat Grass, Foothill Sedge, brome grass, wild oats; see appendix for faunal indicator species.
V.	Freshwater Marsh	Scattered areas around springs, ponds, and sluggish streams.	Common Tule, Calif. Bulrush, Common Cattail, sedge; Longbilled Marsh Wren, Red-winged Blackbird, Yellowthroat, garter snakes, etc. see appendix.

Factors such as elevation, steepness of slope, rainfall, and exposure determine the amount of dessication or evapotranspiration that occurs; and it also determines, along with the soil present, the type of vegetation which occurs in the uplands. The slopes with northeastern exposure undergo less direct sun and direct wind and thus provide a microclimate suitable for the species found in the broadleaf evergreen forest.

TABLE III-3. Upland Biotic Communities of the Livermore Valley

VI.	Oak Woodland	Inner coastal ranges from 400 to 3000 feet; rolling hills along north and south edge of Livermore Valley lowlands.	At lower elevations, Valley Oak, Coast Live Oak; Blue Oak, Digger Pine, at higher elevations. Throughout: Holly-leaf Cherry, Calif. Coffee Berry, Calif. Buckeye, Poison Oak.
VII.	Chaparral	Higher dry slopes and ridges generally throughout the area.	Chamise, Scrub Oak, Holly-leaf Cherry, Buckbrush, Calif. Coffee Berry, manzanita, wild lilac.
VIII.	Broadleaf Evergreen Forest	On higher hills from 200 to 2500 feet in Diablo Range	Tanoak, Calif. Laurel, Madrone, Calif. Buckeye, Golden Chinquapin, Coast Live Oak, Douglas Fir, Digger Pine.

There are also important faunal species associated with the individual plant communities in Alameda County. This has been avoided because it is more desirable to point out that, while one community or another may provide prime or even suitable habitat for a specie, the range of associated species is distributed over two or more plant communities. Each animal needs minimum conditions for survival which may include a portion of several plant communities. Frequently, the borders between each plant community, called an ecotone, contains the most animal activity since it offers the best of both environments. Predator-prey inter-action may be observed in the ecotones becasue of this higher amount of activity. Any list of wildlife species would then not be complete without showing food web inter-action and range characteristics.

TABLE III - 4.

From: The Natural History of the San Francisco Bay Region, A. C. Smith

BIOTIC COMMUNITIES OF THE SAN FRANCISCO BAY REGION

COMMUNITY	LOCATIONS AND EXAMPLES	CHARACTERISTIC PLANTS	CHARACTERISTIC ANIMALS
I. Urban	Cities, towns, and subdivisions enclosing parks, cemeteries, vacant lots, and some extensive eucalyptus forests.	Great variety of introduced trees, shrubs, and garden flowers.	House Finch (Carpodacus mexicanus), English Sparrow (Passer domesticus), Norway Rat (Rattus norvegicus), House Mouse (Mus musculus), American Cockroach (Periplanata americana).
II. Rural	Cultivated crop lands and pasture lands; mostly in Santa Clara, Santa Cruz, Solano, Napa, Sonoma, eastern Contra Costa, and eastern Alameda Counties.	Alfalfa, truck crops, prune, apricot, pear, grape vines, eucalyptus, willows, and poplars.	Barn Owl (Tyto alba), Sparrow Hawk (Falco sparverius), Brewer's Blackbird (Euphagus cyanocephalus), Botta Pocket Gopher (Thomomys bottae), Calif. Vole (M. californicus), Gopher Snake (P. catenifer), Alfalfa Butterfly (Colias eurytheme), Cabbage Butterfly (Pieris rapae).
III. Riparian Woodland	Throughout the area in wooded canyons and along valley watercourses where not destroyed by man. (A) In drier interior ranges of Santa Clara, Alameda, Contra Costa, and Napa Counties. Examples - Pacheco Creek Canyon and Alum Rock Canyon. (B) In ranges west of Santa Clara Valley, north of San Francisco Bay, and in moister canyons of the northern Diablo Range. Examples - Pescadero Creek Canyon.	(A) Western Sycamore (Platanus racemosa), Fremont Cottonwood (Populus fremonti), Red Willow (Salix laevigata), Arroyo Willow (S. lasiolepis). (B) Boxelder (Acer negundo), Big Leaf Maple (A. macrophyllum), White Alder (Alnus rhombifolia), Red Alder (A. rubra), (restricted to within 30 miles of the coast).	Downy Woodpecker (Dendrocopos pubescens), Yellow Warbler (Dendroica petechia), Yellow-breasted Chat (Icteria virens), Raccoon (Procyon lotor), Western Pond Turtle (Clemmys marmorata), Calif. Newt (Taricha torosa), Lorquin's Admiral (Basilarchia lorquini), Mourning Cloak (Nymphalis antiopa), Box Elder Bug (Leptocoris trivitattus), Spotted Tree Borer (Synaphaeta guexi).

TABLE III-4.

BIOTIC COMMUNITIES OF THE SAN FRANCISCO BAY REGION (Continued)

COMMUNITY	LOCATIONS AND EXAMPLES	CHARACTERISTIC PLANTS	CHARACTERISTIC ANIMALS
IV. Grassland	Scattered bits of coastal prairie on hills or in glades along the coast; scattered remnants of valley grassland in coastal valleys of Napa, Alameda, and Santa Clara Counties and in the Great Central Valley which enters our area in Solano County and the northeastern tip of Contra Costa County. Examples - Point Reyes and noncultivated areas in Livermore Valley and adjacent hills.	Blue Bunch Grass (Festuca idahoensis), Calif. Oat Grass (Danthonia californica), Foothill Sedge (Carex tumulicola), brome grass (Bromus spp.) wild oats (Avena spp.)	Western Meadowlark (Sturnella neglecta), Horned Lark (Eremorphila alpestris), Calif. Ground Squirrel (Citellus beecheyi), Black-tailed Jack Rabbit (Lepus californicus), Calif. Vole (Microtus californicus), Gopher Snake (Pituophis catenifer), Field Crickett (Acheta assimilis).
V. Freshwater Marsh	Scattered areas along coast, in back of salty areas. Around springs, ponds, along sluggish streams in Santa Clara, Contra Costa, Napa, Solano Counties. Examples - Searsville Lake; Bear Creek near Point Reyes Station.	Common Tule (Scirpus acutus), Calif. Bulrush (Scirpus californicus), Common Cat-tail (Typha latifolia), sedge (Carex senta and other spp.).	Long-billed Marsh Wren (Telmatodytes palustris), Redwinged Blackbird (Agelaius phoeniceus), Yellowthroat (Geothlypis trichas), garter snakes (Thamnophis spp.), Pacific Tree Frog (Hyla regilla), predaceous diving beetles (Dytiscus spp.), a water scavenger beetle (Hydrophilus triangularis), a giant water bug (Lethocerus americanus).
VI. Oak Woodland	Inner coastal ranges from 400 to 3,000 ft.; Napa, Solano, Contra Costa, Alameda, Santa Clara Counties. Examples - rolling hills along both edges of Santa Clara Valley and along Hwy. 101 in Marin County.	At lower elevations: Valley Oak (Quercus lobata), Coast Live Oak (Q. agrifolia). At higher elevations: Blue Oak (Q. douglasi), Digger Pine (Pinus sabiniana). Throughout: Holly-leaf Cherry (Prunus ilicifolia), Calif. Coffee Berry (Rhamnus californica), Calif. Buckeye (A. californica), Poison Oak (Rhus diversiloba).	Acorn woodpecker (Melanerpes formicivorus), White-breasted Nuthatch (Sitta carolinensis), Brush Mouse (Peromyscus boylei), Calif. Ground Squirrel (Citellus beecheyi), Calif. Sister (Heterochroa california), Calif. Oak Moth (Phryganidea californica), Calif. Prionus (Prionus californicus).

E. Hydrologic Factors

Major Drainage Basins and Water Courses
Central Metropolitan Planning Unit

The Central Metropolitan Planning Unit (CMPU) is divided into a number of small watersheds which are defined by the natural topographic features of the region. The drainage patterns of the unit are characterized by a series of northeast- to southwest-trending linear drainage basins which extend from the ridges of the Oakland Hills, a part of the Diablo Range, across the urbanized alluvial plain to San Francisco Bay. The water-courses which transport runoff from each watershed are typically southwesterly-flowing creeks which have eroded canyons in the hill areas and exhibit a meandering form on the flatter gradient of the alluvial plain.

Eden Planning Unit

The Eden Planning Unit (EPU) has varied physiographic characteristics which result in the definition of two major hydrologic units along with a number of small drainage basins. These units include the basins of San Leandro Creek, San Lorenzo Creek, Sulphur Creek, Ward Creek, and Old Alameda Creek.

Washington Planning Unit

The Washington Planning Unit (WPU) in southern Alameda County is generally characterized by numerous small hydrologic units with the exception of the lower reach of Alameda Creek which drains the largest watershed in the County and traverses the WPU. Most of the natural watercourses in the WPU originate in the vicinity of the ridge of the Mission Hills in the western portion of the unit which reach an elevation of 2,517 feet above mean sea level at Mission Peak. After traveling down the western slope of the hills, the streams emerge onto the alluvial plain and eventually empty into one of the sloughs which meander among the diked salt ponds and then converge with the receiving waters of San Francisco Bay.

The Livermore-Amador Planning Unit may be divided into two major hydrologic units or water basins which extend past the political boundaries of Alameda County. They are the Livermore Hydrologic Unit and the Sunol Hydrologic Unit. The entire area is confined within the Diablo Range and extends over 675 square miles, or 430,000 acres. All streams and creeks flow together in the Livermore Valley near Pleasanton in Arroyo de la Laguna which then flows into Alameda Creek near Sunol and out of the Planning Unit through Niles Canyon. Of the total area land which drains into the Livermore Valley, approximately thirty-five percent is in Santa Clara County in the Mount Hamilton Vicinity. Ten percent of the drainage basin lies in Contra Costa County on the southwestern slopes of Mt. Diablo. The two water basins in the LAPU (Livermore and Sunol) may also be distinguished on the basis of geology, soil infiltration characteristics, and physiography.

There are six different physiographic areas recognized in the Livermore Hydrologic Unit. Clockwise from north to west they are the Orinda upland, Dublin upland, Altamont upland, Livermore Valley, Livermore upland, and Livermore highland. These physiographic areas are based upon elevation, slope, geologic formations, and soils, and relate directly to the hydrologic significance and importance of the area.

The Sunol Valley is located south of the Livermore Valley. The hydrologic unit encompasses the headwaters of the Alameda, Isabel, Arroyo Hondo, and Smith Creeks around Mt. Hamilton. All precipitation falling in these hills drains through the Arroyo Hondo into Calaveras Reservoir; water draining in the Alameda Creek system joins the Arroyo Hondo north of Calaveras Reservoir and flows into Sunol Valley. Within this Sunol Unit, six physiographic areas may be distinguished: Sinbad upland, Vallecitos Valley, La Costa Valley, Sunol Valley, Sunol upland, and Sunol highland.

Precipitation and Runoff Patterns

Precipitation in Alameda County is highly seasonal with almost ninety percent of the annual precipitation occurring during the six-month period of November through April. Most of the precipitation occurs as rainfall in a series of general storms which affect all portions of the County; however, variations in local physiography strongly influence the intensity and amount of precipitation. As illustrated on the accompanying isohyetol map, precipitation patterns within the County vary with elevation, proximity to major water bodies, wind direction, and the different relationships among these major climatic influences.

Runoff in Alameda County is derived from precipitation on the various drainage basins and from imported water released into the natural watercourses. The direct relationship between precipitation and runoff results in yearly and seasonal runoff patterns which are similar to rainfall variations. Thus, under natural conditions, streams in the County exhibit highest flows during the winter storm season and are essentially dry during the summer. Imported water discharged into streams in the Livermore Valley, diversions, and water storage reservoirs have altered the natural runoff characteristics of the major watercourses in the County.

TABLE III-5.

RECORDED ANNUAL DISCHARGE OF VARIOUS STREAMS IN ALAMEDA COUNTY[1]

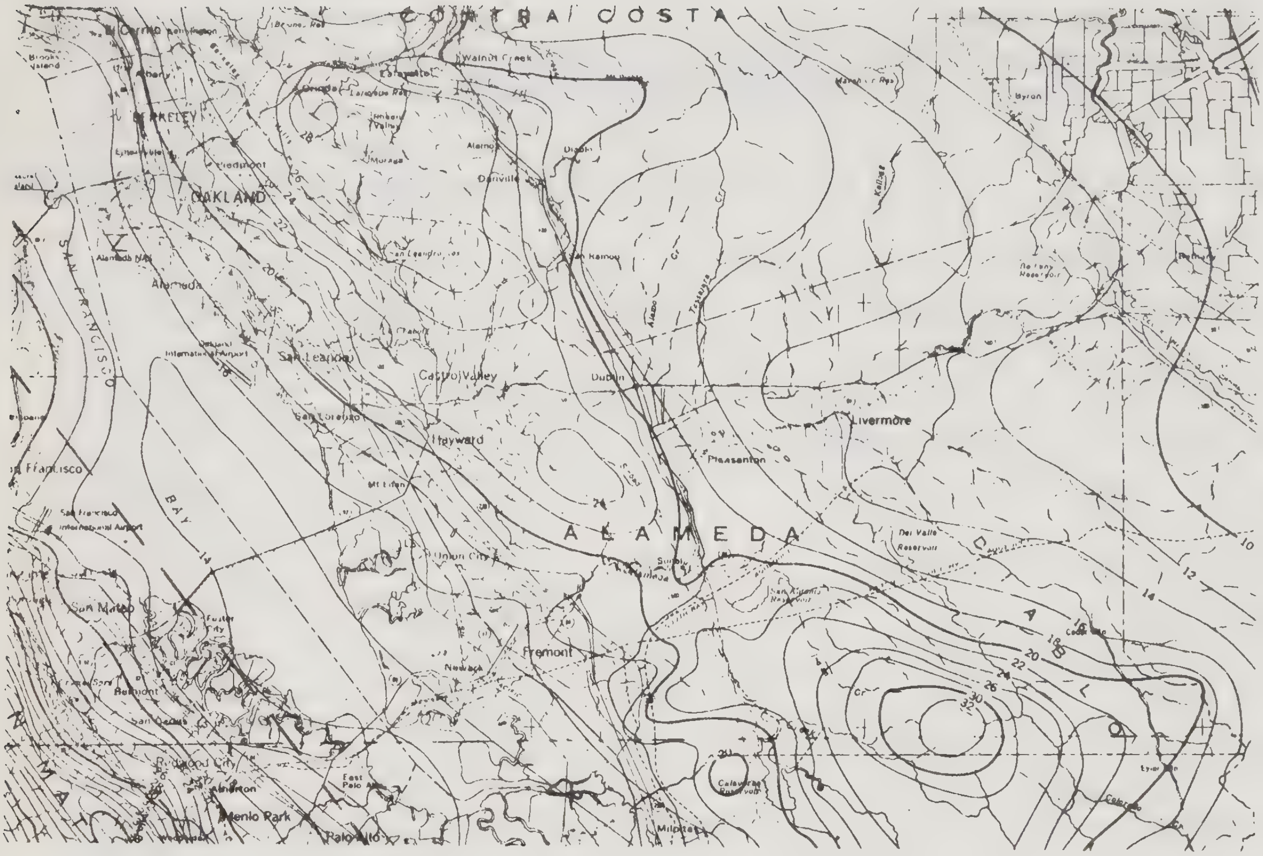
Stream	Location	Area (Miles^2)	Years of Record	Mean Annual Discharge (acre-feet)
Alameda Creek Basin				
Arroyo Mocho	Livermore	38.2	1912-1930	2,920
Arroyo Mocho	Pleasanton	141	1962-1972	9,640
Arroyo del Valle	Above Reservoir	126	1963-1972	18,760
Arroyo del Valle[2]	Livermore	147	1912-1930 1957-1968	21,450
Arroyo de la Laguna	Pleasanton	405	1912-1930	30,790
Alameda Creek[3]	Niles	633	1891-1962	89,050
Alameda Creek[3]	Niles	633	1963-1972	63,180
Dry Creek	Union City	9.41	1916-1919 1959-1972	1,170
Other Basins				
San Lorenzo Creek[4]	Hayward	37.5	1946-1972	10,140
Castro Valley Creek	Hayward	5.51	1971-1972	1,090

[1] United States Geological Survey, Water Resources Data for California, Part 1, Surface Water Records, 1972

[2] Beginning in 1968, discharges at this station were regulated by Del Valle Reservoir. Water from the South Bay Aqueduct can be pumped to the reservoir and released for downstream percolation.

[3] Flow regulated by Calaveras Reservoir beginning in 1916, San Antonio Reservoir beginning in 1965, and Del Valle Reservoir. Imported water affected flow beginning in 1962.

[4] Flow partially regulated by Cull Creek Reservoir beginning in 1962 and Don Castro Reservoir beginning in 1965.



SOURCE: Rantz, S. E., Mean Annual Precipitation and Precipitation Depth Duration-Frequency Data for the San Francisco Bay Region, California, USGS, S.F. Bay Region Environment and Resources Planning Study, Basic Data Contribution 32, 1971.

Lakes, Reservoirs, and Other Surface Water Storage

Surface water resulting from precipitation or imports may be stored in a variety of facilities of either natural or man-made origin. Natural surface storage is accomplished by lakes, ponds, marshes, and bogs while man-made facilities include concrete and earth-fill dam-created reservoirs, enclosed steel and concrete reservoirs, and diked areas. The relative absence of any significant natural surface storage in the County and the seasonal nature of prevailing precipitation patterns have necessitated the construction of many surface storage basins in appropriate locations.

TABLE III-6.

MAJOR SURFACE RESERVOIRS IN ALAMEDA COUNTY

Name	Stream	Capacity (acre ft.)	Agency[1]	Major Purpose
Del Valle	Arroyo Del Valle	77,000	DWR	Water supply, recreation flood control
Bethany	Calif. Aqueduct	4,850	DWR	Water supply
Calaveras	Calaveras	100,000	SFWD	Water supply
San Antonio	La Costa	51,000	SFWD	Water supply
Chabot	San Leandro	10,000	EBMUD	Water supply, recreation
Upper San Leandro	San Leandro	41,000	EBMUD	Water supply
Cull	Cull	295	ACFCWCD	Recreation, water conservation
Don Castro	San Lorenzo	380	ACFCWCD	Recreation, water conservation

[1] DWR - Department of Water Resources
SFWD - San Francisco Water District
EBMUD - East Bay Municipal Utility District
ACFCWCD - Alameda County Flood Control and Water Conservation District

Water Quality Management Conditions

The management of water quality in Alameda County is a complex problem which must be approached with an understanding of the systematic nature of the hydrologic cycle. It is only possible to achieve desired water quality through a program which acknowledges the interactions involved and implements procedures to manage the resource on a regional basis. Toward this end, the San Francisco Bay Regional Water Quality Control Board was established to formulate water quality objectives and policies and to enforce specific regulations and requirements. The Bay Area Sewage Service Agency was subsequently created to deal with the specific problems of wastewater treatment and disposal.

Water quality problems in Alameda County may be divided into three interdependent categories: bay water, land based surface water, and groundwater. Desirable levels of water quality are based primarily on the current use of the water but also must consider man's potential needs and technological abilities. Once standards are established, a difficult task which is constantly being modified by new information, and it is established that a problem does exist it is necessary to identify sources and implement programs to eliminate or mitigate the source. The key primary carriers of pollutants are surface creeks and lakes which replenish groundwater basins and subsequently discharge to the bay.

Current major sources of pollutants include wastewater treatment plants, direct sewage discharges, urban runoff, irrigation waters, industrial effluent, accidental oil and chemical spills, and dredging. Water quality problems resulting from these sources include dissolved oxygen depletion, health hazards from high bacteriological concentrations, biostimulation, toxicity, pesticide accumulation, and excess floatable hydrocarbons.

Quality of the EBMUD water supply sources and the City of Hayward sources are dependent upon conditions in the watersheds from where their supply is imported. Quality of the groundwater source managed by ACWD in the Washington Planning Unit was discussed earlier to some extent with regard to saltwater intrusion. However, another important factor affecting groundwater quality in the Washington Planning Unit is the quality of replenishment waters. While much of the recharge in WPU is from local precipitation and runoff and imported sources, a significant portion is generated from the Alameda Creek basin located largely in LAPU. Thus, the quality of surface runoff in this basin is important to the water resource in the Niles Cone as well as the groundwater reservoirs in the Livermore Valley.

The quality of surface runoff from the Alameda Creek Basin is generally good except during periods of low flow when natural or imported water runoff is insufficient to dilute wastewater discharges from treatment plants in the valley. The City of Livermore wastewater treatment plant and the Valley Community Services District plant discharge significant amounts of effluent to Arroyo Las Positas and the Alamo Canal, respectively, which have the potential to degrade surface water in downstream areas and groundwater basins in both the Livermore-Amador and Washington Planning Units. Additional treated effluent is disposed by irrigation of rangeland with effluent and evaporation from ponds. The high salt content of the effluent is the most significant problem as it probably contributes to excessive mineral concentrations in groundwater.

IV. ANALYSIS OF ENVIRONMENTAL FACTORS

A. Geologic Limitations[1]

1. Geologic Formations and Their Water-Bearing Characteristics:

The Alameda County area consists of a folded and faulted portion of the Diablo Range on the east and the San Francisco Bay structural depression on the west. The most prominent faults and the axes of major folds in the area commonly trend northwesterly. Several intermontane valleys, chief among which are the Livermore, Sunol, and Castro Valleys, are present within the Diablo Range. Livermore Valley, the largest of these, has been formed in an east-west trending syncline of Plio-Pleistocene sediments.

The rocks in the Alameda County area range in age from the Franciscan formation of the Jurassic period to recent alluvial and tidal deposits. The older formations occur mainly in the mountainous areas and underlie younger sediments in the valleys. These have been divided into two groups: nonwater-bearing and water-bearing. This division is based on the ability of the formation to yield water to wells. As used herein, a water-bearing formation is one that absorbs, transmits, and yields water readily to wells, and conversely, a nonwater-bearing formation is one from which wells produce relatively limited quantities of water. In general, this division can be based also on age, since only the Quaternary and to some extent the late Tertiary (Pliocene) formations have sufficiently high permeability to be classed as water-bearing, while the pre-Pliocene (older Tertiary, Cretaceous and Jurassic) formations are considered to be nonwater-bearing.

Nonwater-Bearing Rock Units

Rocks of the nonwater-bearing group are exposed throughout the Diablo Range south of Livermore Valley, in the hills and ridges east of the San Francisco Bay plain and between Livermore and San Joaquin Valleys, and in the Coyote Hills west of Fremont. The geologic units in this category include Jurassic to Pliocene marine sedimentary rocks, serpentine and Orhyolite. These nonwater-bearing rocks extend at various depths beneath the water-bearing sediments which fill Livermore, Sunol, and Santa Clara Valleys.

Marine rocks of Jurassic age (indicated by "J" on the generalized geologic map of Alameda County) comprise nearly the entire southern half of the watershed within the Livermore and Sunol highlands. They are also exposed in Oakland-Berkeley Hills, the Coyote Hills, and in slivers along the Hayward fault. These rocks are the oldest exposed in the area and are mapped as the Franciscan Group. The Franciscan Group is composed primarily of sandstone with smaller amounts of interbedded siltstone and shale. Minor rock types include conglomerate, various colored chert, altered igneous rocks (greenstone) and small irregularly shaped bodies of serpentine.

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[1] This report was compiled by David M. Hill, Senior Engineering Geologist, California State Department of Water Resources, Sacramento, June 21, 1974.

Rocks of Cretaceous age (indicated by "K" on the generalized geologic map) are exposed over large areas in the hills east of the Hayward fault and west of Livermore Valley, northeast of Livermore Valley, and south of Livermore Valley along the middle reaches of Arroyo del Valle. These rock types consist primarily of sandstone, shale, conglomerate, and siltstone, all of marine origin.

Formations in the lower Cretaceous have been mapped by various workers as Oakland Conglomerate, Niles Canyon, and Horsetown Formations. Upper Cretaceous rocks have been mapped as the Berryessa, Del Valle, Moreno Grande, Panoche, and Chico Formations.

Cretaceous rocks are found in the area only in fault contact with the older Franciscan rocks, but are known elsewhere to unconformably overlie them.

Rocks of Eocene age (combined under the symbol "T" on the map) have been mapped in only two small exposures, southeast of Livermore Valley and at the north end of the watershed. These rocks consist of conglomerate, shale, sandstone, and occasional coal seams, and have been described as the Tesla, Tolman, and Tejon Formations.

Rocks of Miocene age (also indicated by "T" on the map) are exposed over a wide area bordering the two ground water basins on the east, west, and south, and as a narrow strip near the northeast boundary of the Livermore drainage unit. They have been described under a number of formational names within the lower and upper Miocene.

Middle Miocene rocks include marine sandstone, shale, tuffaceous beds, and some chert and are mapped as the Oursan, Claremont, Sobrante, and Monterey Formations.

Upper Miocene rocks include green sandstone, siltstone, shale, conglomerate, tuff, and some coal seams and are divided into the Neroly, Cierbo, Briones, Hambre, and Tice Formations.

Rocks of early Pliocene age (grouped with the other Tertiary formations) unconformably overlie the upper Miocene rocks and include the oldest evidence of continental deposition. Fresh water deposits of sandstone, conglomerate, siltstone, and claystone, with small amounts of tuff and limestone are exposed as the Orinda Formation located largely north of Livermore Valley. The Orinda is not well indurated, but the abundance of fines in the formations make it essentially nonwater-bearing.

Nearly all of the rock types comprising the nonwater-bearing formations are consolidated and of low permeability; they do not have primary openings large enough to allow movement of ground water. Ground water contained in these rock types exists largely in secondary openings formed by fractures, joints, shear zones, and faults. The secondary openings provide minimal storage space and avenues for movement of ground water, and explain the ability of these rocks to provide small quantities of water to wells. Because secondary openings are not present uniformly in

any given rock type or geographic area, the ability of the rock to yield ground water to wells is quite variable and is dependent largely on structural conditions. The hydrologic importance of the rocks in the nonwater-bearing group lies primarily in their ability to slowly yield ground water to springs, thus providing perennial flow in many streams draining the highlands that would otherwise be dry in summer.

Domestic water supplies are obtained from nearly all types of rocks in the nonwater-bearing group, springs being the most common source. The springs occur chiefly along faults and fractures; and at most of the ranches in the hills where spring water is not available, wells may yield fair amounts of water in local areas where geologic structures and rock types are favorable.

The quality of ground water in the rocks of the nonwater-bearing group is often poor. Most of these rocks are of marine origin and consequently still retain some of the salts of the original connate waters. The salts in some of the coarser-grained facies have been leached out and the rocks locally contain small quantities of good-quality ground water. Slow migration of the salts from the fine-grained rocks into adjacent ground water is still taking place.

Water-Bearing Units

The sediments comprising the water-bearing units are unconsolidated to semi-consolidated. In contrast to the older nonwater-bearing rocks, the water-bearing units contain ground water in the primary openings between the clastic grains. These grains range in size from clay to silt, sand, and gravel, and reach a maximum of boulder size in certain areas.

Materials of the water-bearing group make up the entire valley floor of Livermore and Sunol Valleys and the East Bay Plain as well as the lower portions of La Costa and Vallecitos Valleys. They also occur to the west, south, and north of Livermore Valley and east of Sunol Valley. Under most conditions, these materials yield adequate quantities of ground water to all types of wells. The quality of the water produced ranges from poor to excellent, with most waters in the good to excellent range.

The oldest of the water-bearing formations in Alameda County is the Tassajara Formation. This formation is of Pliocene age and occurs north of Livermore Valley and also beneath the central portion of the valley at depths which range from 200 feet to 750 feet. Postdepositional deformation has folded and tilted the beds of the Tassajara Formation into a number of northwest-southeast trending anticlines and synclines. These beds are composed of sandstone, siltstone, shale, conglomerate, and limestone. The sandstones ordinarily would be expected to have a fair degree of permeability. However, the presence of tuff and clay particles reduces its overall permeability; and wells tapping the Tassajara Formation yield only sufficient water for domestic, stock, or limited irrigation purposes. Ground water contained in this formation is of sodium bicarbonate character of moderately good quality.

Because of the regional dip of the beds in the Tassajara Formation, and also because of the presence of fine-grained materials which act as confining beds, there is little, if any, hydrologic continuity between ground water in the Tassajara Formation and that in the overlying materials. The lack of hydrologic continuity and the relatively low yield of wells are the bases for excluding the large area of exposure of Tassajara Formation north of Livermore Valley from the ground water basin.

The Livermore Formation is exposed over broad regions south of Livermore Valley and east of Sunol Valley. Limited exposures occur on the north and west side of Livermore Valley, as well as to the west of Sunol Valley. The Livermore Formation also occurs beneath the floors of Livermore and Sunol Valleys, occurring at depths ranging from a few tens of feet to over 400 feet.

The Livermore Formation occurs generally as beds of clayey gravel in a sandy clay matrix. To the south of Livermore Valley these beds dip toward the north. They are nearly flat under the valley, and they dip gently to the south along the north edge of the valley where they lap onto the Tassajara Formation. This formation is a significant water-bearing formation in the Livermore Valley area. All of the deep wells in the eastern half of the valley produce from this formation. Yields to wells are adequate for most irrigation, industrial, or municipal purposes. Like the underlying Tassajara Formation, ground water in the Livermore Formation is of sodium bicarbonate character and of good quality.

The Santa Clara Formation is exposed most prominently in the upland between Mission San Jose and the County line along Scott Creek. In the Mission Upland, exposures of the Santa Clara Formation in several sand and gravel quarries show that well-sorted gravel lenses with practically no fines occur up to several feet thick and many feet long. These beds appear to be very permeable, and if they are common throughout the Mission Upland, they may account for the relatively high production of some wells in that area. Some gravel beds have yielded the bones of large mammals of Pleistocene age, thereby establishing at least a portion of the Santa Clara Formation as being no older than lower Pleistocene.

Stream cross-bedding, scour and fill, lenticular shapes of beds, and the extreme range in sorting seen in the Mission Upland, all point to stream deposition. The presence of abundant vertebrate remains and the lack of marine fossils also suggests a continental environment. Well data show that the permeability of the Santa Clara Formation tends to decrease from east to west toward the bay; hence, the highest production of wells is reported to be in the Mission Upland, on the eastern side of the basin.

Well logs show that the sediments also tend to decrease in grain size and permeability with depth. Elsewhere, the Santa Clara Formation shows a very consistent character of obscurely bedded, poorly sorted, pebbly sandstone, siltstone, or clay. In addition, exposures show the effects of multiple and continued sliding, such as chaotic bedding and curved slickensided surfaces suggestive of the tectonic activity which is still being recorded in the area.

The Quarternary alluvial formations are the most important water-bearing units in Alameda County. They include: older alluvial fan deposits, Merritt Sand, interfluvial basin deposits, younger fluvial deposits, younger alluvial fan deposits, and stream channel material. These are composed of gravel, sand, silt, and clay, and various mxitures of these grain sizes, all of which are generally unconsolidated. The sand and gravel deposits have the highest permeability and are thus the major aquifers. Conversely, the silt and clay layers have low permeability and, therefore, form confining beds or aquitards.

In Livermore Valley, the Quarternary alluvial or valley-fill materials overlie the Livermore and Tassajara Formations and range in thickness from a few feet to nearly 400 feet. Ground water is under unconfined or water table conditions in the shallowest aquifers and is confined or artesian in the deeper aquifers. Faults which cut the sediments have formed partial barriers to ground water movement. Yields from properly designed wells tapping the valley-fill materials are sufficient for any type of high capacity use. Ground water quality generally is excellent except for local areas where concentrations of chlorides or nitrates are significantly high.

Quaternary alluvium at the base of the hills along the East Bay Plain was deposited as a series of alluvial fans by streams draining out of the highlands and onto the valley floor. The sediments dropped by the larger streams grade from gravel and boulders at the apexes of the fans to fine sand and silt near the Bay. During periods of normal runoff the stream courses would be established with coarse-grained materials being deposited in the channels and fine-grained materials away from the channels. During major floods the old channels would be abandoned and new channels would be formed down the surfaces of the fans. At times the meandering streams would swing back and forth over relatively short distances, leaving behind braided channel deposits. The abandoned stream channels were buried with younger, usually finer-grained sediments. Those old channels now are encountered as tubular aquifers. Water level data indicate that some of the aquifers are interconnected in varying degrees. In some cases, the buried channels have been cut off by regional tilting and faulting. The physiographic characteristics of the recent alluvial fans are recognizable today.

Sea level did not remain static during the formation of the alluvial fans and plains in the East Bay Plain ground water area. Sea level dropped 200 to 300 feet lower than it is now during the major advances of continental glaciers during the Pleistocene. At such times, the ancestral Santa Clara Valley occupied the entire South Bay area. Alameda Creek and other Bay Area streams meandered across a verdant valley floor possibly joining the Sacramento River near the Golden Gate. This ancient stream deposit now forms aquifers beneath the Bay muds in the South Bay area.

As sea level rose during interglacial periods, the alluvial channel deposits were buried beneath bay muds. During some interglacial period sea level rose higher than it is today. As a consequence, blue marine clays are found interbedded with the alluvial fan deposits. At times of higher than normal sea level the sediments deposited by the larger streams might be characterized as deltaic rather than alluvial.

The depth to the base of Quaternary alluvium cannot be readily determined, as the similarity in lithology between it and the underlying Santa Clara and Livermore Formations precludes distinguishing these units on the basis of the data available. However, well log descriptions make it possible to distinguish between the water-bearing group and nonwater-bearing rocks at depth.

2. Geologic Constraints for Solid Waste Disposal Sites:

The Generalized Geologic and Hydrologic Map of Alameda County classifies the geologic formations according to their water-bearing characteristics. The areas of nonwater-bearing rocks should contain some sites that would be geologically and hydrologically suitable for a waste disposal site. It is recognized that site suitability in many nonwater-bearing areas will be limited by other environmental constraints.

Class I Areas. Class I disposal sites are those at which the ground and surface waters of the County are protected for all time from the wastes deposited therein. A Class I site is the only site in which Group I wastes may be deposited. Examples of Group 1 wastes are brines from food processing, water treatment, oil well or other facilities, ashes and mine tailings containing toxic chemicals, and agricultural chemicals such as pesticides, herbicides, and certain fertilizers. Class I areas must exhibit geologic conditions that preclude the vertical or lateral percolation of effluent or leachate into any body of useable ground water.

Suitable areas for the location of Class I sites are limited to the nonwater-bearing rocks. These rocks, of Jura-Cretaceous to Tertiary age, are of marine origin and do not contain useable ground water. The only water contained in them is saline and of very poor quality. Most of the marine rocks are of very low permeability and thus would inhibit the infiltration of toxic chemicals. Furthermore, the geologic structure (anticlines and synclines) would cause any infiltrating chemicals to migrate down dip, which in some cases is as steep at 65^{o}. Fluids migrating down such a steep slope eventually would be at a fairly great depth below ground. These fluids ultimately would be concentrated along the troughs of synclines.

Class II Areas. Class II disposal sites are those at which protection is provided to the quality of ground and surface water from Group 2 wastes. Examples of Group 2 wastes are municipal garbage and rubbish, paper, wood, roofing materials, dead animals, and manure. Class II sites must be so located that either natural or artificial conditions prevent the lateral and vertical hydraulic migration of the leachate to the underlying useable ground water or adjacent useable surface water.

Class II must be properly designed to meet the discharge requirements established by the Regional Water Quality Control Board as well as to meet other environmental and social criteria. Areas in which Class II sites should be allowed are those which conform to those constraints necessary to protect the environment.

Class III Areas. Class III sites are those at which only Group 3 materials can be deposited. Group 3 materials consist entirely of nonwater soluble, nondecomposable inert solids, examples of which are construction and demolition debris such as earth, rock, and concrete, glass slag, inert plastic, and waste clay products. Disposal sites located in or adjacent to stream channels or other bodies of water should be limited to the acceptance of Group 3 wastes only.

3. Geologic and Hydrologic Factors Governing Waste Disposal to Land[1]:

On March 2, 1972, the State Water Resources Control Board adopted Subchapter 15 as an addition to Chapter 3 in Title 23 of the California Administrative Code. This new subchapter governs waste disposal to land and establishes a disposal site and waste classification system on a statewide basis. The classification of disposal sites is based upon the geologic and hydrologic features of the disposal area and the capability for protection of surface and groundwater quality. The categorization of wastes is based upon the threat that the type of waste material presents to water quality.

More than one class of disposal area may be established within a disposal site. This may be necessary because of the varying conditions which may occur within a site (i.e., different geological conditions, the provision of a barrier in one portion of the site, or different ranges of flooding potential).

Article 2. Classification of Waste Disposal Sites

2510. Class I Disposal Sites. Class I disposal sites are those at which complete protection is provided for all time for the quality of ground and surface waters from all wastes deposited therein and against hazard to public health and wildlife resources. The following criteria must be met to qualify a site as Class I:

(a) Geological conditions are naturally capable of preventing vertical hydraulic continuity between liquids and gases emanating from the waste in the site and useable surface or ground waters.

(b) Geological conditions are naturally capable of preventing lateral hydraulic continuity between liquids and gases emanating from wastes in the site and useable surface or ground waters, or the disposal area has been modified to achieve such capability.

[1] Excerpts from the Waste Discharge Requirements for Waste Disposal to Land, California State Water Resources Control Board, April, 1974.

(c) Underlying geological formations which contain rock fractures or fissures of questionable permeability must be permanently sealed to provide a competent barrier to the movement of liquids or gases from the disposal site.

(d) Inundation of disposal areas shall not occur until the site is closed in accordance with requirements of the regional board.

(e) Disposal areas shall not be subject to washout.

(f) Leachate and subsurface flow into the disposal area shall be contained within the site unless other disposition is made in accordance with requirements of the regional board.

(g) Sites shall not be located over zones of active faulting or where other forms of geological change would impair the competence of natural features or artificial barriers which prevent continuity with useable waters.

(h) Sites made suitable for use by man-made physical barriers shall not be located where improper operation or maintenance of such structures could permit the waste, leachate, or gases to contact useable ground or surface water.

(i) Sites which comply with a, b, c, e, f, g, and h but would be subject to inundation by a tide or a flood of greater than 100 year frequency may be considered by the regional board as a limited Class I disposal site.

2511. Class II Disposal Sites. Class II disposal sites are those at which protection is provided to water quality from Group 2 and Group 3 wastes. The types of physical features and the extent of protection of ground water quality divides Class II sites into the two following categories:

Class II-1 sites are those overlying useable ground water and geologic conditions are either naturally capable of preventing lateral and vertical hydraulic continuity between liquids and gases emanating from the waste in the site and useable surface or ground waters, or the disposal area has been modifed to achieve such capability.

Class II-2 sites are those having vertical and lateral hydraulic continuity with useable ground water but for which geological and hydraulic features such as soil type, artificial barriers, depth to ground water, and other factors will assure protection of the quality of useable ground water underneath or adjacent to the site.

The following criteria must be met to qualify a site as Class II:

(a) Disposal areas shall be protected by natural or artiifcial features so as to assure protection from any washout and from inundation which could occur as a result of tides or floods having a predicted frequency of once in 100 years.

(b) Surface drainage from tributary areas shall not contact Group 2 wastes in the site during disposal operations and for the active life of the site.

(c) Gases and leachate emanating from waste in the site shall not unreasonably affect ground water during the active life of the site.

(d) Subsurface flow into the site and the depth at which water-soluble materials are placed shall be controlled during construction and operation of the site to minimize leachate production and assure that the Group 2 waste material will be above the highest anticipated elevation of the capillary fringe of the ground water. Discharge from the site shall be subject to waste discharge requirements.

2512. Class III Disposal Sites. Class III disposal sites are those at which protection is provided to water quality from Group 3 wastes by location, construction, and operation which prevent erosion of deposited material.

DATA SOURCES FOR

GENERALIZED GEOLOGIC AND GROUND WATER MAP

OF ALAMEDA COUNTY

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B. Soil Characteristics and Limitations for Locating Waste Disposal Facilities

Land disposal of solid and liquid wastes will be directly affected by the soils present at the disposal site. The soil types which have been identified in Alameda County have varying characteristics which constrain the disposal of materials, solid or liquid, and which must be observed in determining site locations. As an early warning system for planners and decision makers, ten interacting factors have been identified. These factors form the criteria for evaluating limitations due to soil characteristics.

The criteria listed below were developed for this study cooperatively by the U. S. Department of Agriculture, Soil Conservation Service, the Alameda County Resource Conservation District, and the County Planning Department. They are based upon national guidelines published by the Soil Conservation Service for evaluating soil limitations at landfill sites. The national guidelines have been modified and interpreted by a local soil scientist and engineer, planners, and a resource conservationist to apply to the soils found within Alameda County.

Use of the criteria must be confined to soils found within the Alameda County Soil Survey, March, 1966, although modifications could be made based upon soil conditions in other areas. The criteria contained herein were intended to be used in conjunction with the Soil Survey. Such complete information has been included in that report that it has not been duplicated here. Any attempt to use the criteria without the Soil Survey would be meaningless.

A brief description of the Soil Associations identified in the County has been included here for general information and orientation.

The focus of the Alameda County Soil Survey of 1966 was on land that was least urbanized and had high or potentially high agricultural productivity. For this reason the areas west of the Hayward and Fremont Hills are just now being mapped as are some of the metropolitan areas in the northwestern portion of the county. The soil survey was intended for agricultural use but recently it was recognized that the wide range of information derived from the Survey was indispensible for land management, land use, and environmental analyses. Thus, the survey is being revised and expanded to include areas in the western part of the county. Contained within the Survey is a wealth of information about the soils ranging from physical soil types, to engineering properties, to conservation and management needs and policies.

The Soil Survey presents a vast array of information to us depending upon the interest we have and the need we wish to fulfill. Initially, the seven major soil associations that are found in the County are described. Soil associations are the identified patterns that the soils fall into. In the Survey, three associations are identified as Upland Soils and four as Terraces, Alluvial and Flood Plain Soils.

Table IV-1.
Alameda County Soil Associations[1]

Soils of the Uplands

1. Altamont-Diablo association: Moderately steep and very steep, brownish and dark gray, moderately steep soils on soft sedimentary rocks.

2. Vallecitos-Parrish association: Moderately steep and very steep, brownish and reddish-brown soils on metasedimentary and basic igneous rocks.

3. Millsholm-Los Gatos-Los Osos association: Moderately sloping to very steep, brownish soils on moderately hard sedimentary rocks.

Soils of the Terraces, Alluvial Fans, and Flood Plains

4. Yolo-Pleasanton association: Nearly level to sloping, grayish-brown, very deep soils on flood plains and low terraces.

5. Positas-Perkins association: Nearly level to very steep, brown, shallow to moderately deep soils on high terraces.

6. Clear Lake-Sunnyvale asssociation: Nearly level to sloping, dark gray, very deep, well-drained to imperfectly drained soils on flood plains and basins.

7. Rincon-San Ysidro association: Nearly level, shallow to very deep, pale brown and grayish-brown soils on older fans and flood plains.

Tables containing characteristics for each soil type found within a particular soil association are compiled in the Soil Survey. From these tables ten major items affecting the use of the soil for landfilling were selected. Those items are:

- depth to seasonal water table
- rainfall
- proximity to water supply (lake, reservoir)
- soil permeability
- flooding
- soil drainage class
- slope
- hydrologic soil group
- erosion hazard
- effective depth.

[1]USDA Soil Conservation Service, Soil Survey: Alameda Area, California, March, 1966.

Soil characteristics vary from type to type as well as at each location. In order to identify the potential threat to local conditions a breakdown of slight, moderate, and severe was applied to the range of the ten characteristics selected. The term "potential threat" should be interpreted to mean the identification of areas in which environmental degradation may occur. The "moderate" or "severe" rating for any item indicates that the site should be subjected to a thorough evaluation prior to use for disposal of wastes.

TABLE IV-2.

Criteria for Evaluating Limitations
Due to Soil Characteristics for Locating Waste Disposal Facilities
Alameda County, California

Item Affecting Use	Degree of Soil Limitation: Slight	Moderate	Severe
Depth to Seasonal[1] Water Table	>60"	40"-60"	<40"
Rainfall	0-10"	10"-15"	>15"
Locational Concerns with Relation to Water Supply	Not over or near	1 mile & upstream or over	Adjacent to upstream from or over
Soil Permeability[2]	0"-1"/hr	1"-2"/hr	>2"/hr
Flooding	None 100 year	Rare 50 yr	Occasional 10 yr or
Soil Drainage Class[1]	Excessive Good Moderately good	Moderate Imperfect	Imperfect Poor Very poor
Slope	0-10%	10-20%	>20%
Hydrologic Soil Group[3]	D	C	A,B
Erosion Hazard[4]	None Slight	Moderate	Severe Very Severe
Effective Depth[5]	60" 36"-60"	20"-36"	<20"

[1]Reflects influence of wetness in operation of equipment.

[2]Reflects ability of soil to retard movement of leachate from landfills; may not reflect a limitation in arid and semi-arid areas.

[3]Hydrologic soil groups: Group A - high infiltration even when wet; deep, well-drained, sandy and gravelly soils; Group B - above average infiltration rate even when thoroughly wet; usually moderately deep to deep, moderately well-drained to well-drained, with moderately coarse to moderately fine texture; Group C - below average infiltration rate; possibly contains layer which impedes downward infiltration; moderately fine to fine textured; Group D - very slow infiltration rate; primarily clays with high shrink-swell potential; some soils with high water table included; some have restrictive layer at shallow depth; very slow rate of water transmission.

[4]Erosion hazard is an estimate of the risk of erosion if the soil is cultivated or heavily grazed. Ratings refer to the risk of erosion by water.

[5]Effective depth is the depth of soil readily penetrated by roots. It is the depth to a clay pan, bedrock, or any other layer in the soil that would stop or greatly hinder the generation of roots.

Note: Other factors affecting the location of waste disposal facilities would also be important in making the site location decision. This criteria is intended to be the early warning system for decision making which reveals the need for further in-depth investigations. It should not be used to evaluate a specific disposal site; this criteria therefore does not take the place of the site specific soils, hydrologic, or geologic investigations.

[6]Locational concerns with respect to water supply - identification of the watershed surrounding a disposal site should also include the location of reservoirs, springs, ponds, and ground water since percolation of leachate should be restricted to the smallest area on the disposal site.

TABLE IV-3

SOIL SUITABILITY RATINGS

Item Affecting Use	Degree of Soil Limitation Good	Fair	Poor
Moist Consistence	Very friable friable	Loose, firm	Very firm, extremely firm
Texture	Sandy loam, loam silt loam, sandy clay loam	Silty clay loam, clay loam, sandy loam, loamy sand,	Silty clay, clay, muck peat sand
Thickness of Material (depth to bedrock)	40"	20"-40"	20"
Coarse Fragments—presence (0-10") % volume	15%	15-35%	35% (gravel)
Slope (erosion control)	0-15%	15-30%	30%
Drainage Class	Not class determining if better than poorly drained		Poor to very poor

C. Vegetation/Habitat Modification

Disposal sites have been traditionally located on the fringes of cities or adjacent to urban areas. The requirement imposed upon the County by SB-5 is to develop a landfill with at least 20 years of capacity. This will necessitate seeking an area which is more remote than present sites but which will no doubt have the same impacts on the natural environment as the old sites. While we will have to live with the old sites, some of the newer ones along with the future sites must be carefully scrutinized to determine effects to the natural environment.

As has been discussed, plants and animals form associations which vary in time and space. Three major factors which act as determinants of community structure are dispersal, challenges of the physical environment and challenges of the biotic environment. The complex interaction which occurs within these associations determines the stability and viability of the individual species within the association. Man's interference no matter how slight always will affect the natural equilibrium or balance in many ways.

Rather than describe all possible changes which could occur in locating a facility in a relatively remote area, a number of indicators have been identified. Though the list is not exhaustive it does indicate the areas of primary concern. Comprehensive site/proximity report would be expected for each new site.

- Change in vegetal diversity, density, and cover.
- Change in faunal diversity, density, dispersal, both wild and domestic.
- Loss of faunal or floral species - may be caused by inadequate adjustment to new population densities and pressures or competition and the cultural impact of those changes.
- Alteration in physical habitat such as temperature, precipitation, hydrologic cycle, impervious surfaces, soil removal, or deterioration in water quality.
- Changes in resource availability such as nutrient depletion or buildup, extinction or reduction of food, etc.

In addition changes which may occur on the site or in the vicinity of the site might include some of the following conditions.

1) Vegetation of high brush or forest fire potential proximal.

2) Highly productive habitat for wildlife species of sport, spectator, commercial or educational value on site.

3) Relatively undisturbed or unique vegetation and wildlife communities on site or plant life of special historic or scenic value.

4) Rare or endangered species.

5) Areas of low vegetation potential on site (low fertility/lack of seed sources).

D. <u>Hydrologic Limitations</u>

Land disposal of solid wastes or liquids and sludges is subject to hydrologic limitations. The effects of these wastes on water quality are dependent upon the characteristics of the waste material.

1. Effects on Water Quality[1]:

The effect that a disposal area may have on ground water is dependent upon proximity to ground water, types of intervening soils between the disposal area and the ground water, waste materials in the disposal area, rate of water infiltration, etc. Water quality problems have been observed at several sites.

The effect of the disposal of solid wastes such as refuse on ground water quality has been found to be limited to the immediate area around the disposal area. In humid climates, the higher rates of rainfall cause greater recharge of the ground water and substantial dilution and assimilation of the resultant pollutants. This results in no appreciable adverse effects to be noted in the ground water located relatively short distances from a disposal area. Through proper site selection and utilization of necessary waste control measures, solid waste disposal can be accomplished without creating a threat to water quality.

The following is a brief summary of the possible effects of solid wastes on water quality if effective control measures are not utilized.

Physical Impairment

Physical effects include floatables, turbidity or discoloration or odors caused by dumping wastes into the ocean, bays, lakes and streams or over stream banks with subsequent erosion of the materials during periods of flooding or high water conditions.

Leachate

The components of a leachate are dependent upon the material's being leached. Leachate from demolition materials composed of wood and metal has a lower content of dissolved organics and minerals than leachate from general refuse under equivalent moisture and time phase conditions. The leaching of general refuse commonly causes increases in concentrations of organic substances, hardness, chloride, iron, sulfate, and total dissolved solids in the percolating water. These conditions may be caused by contact of a disposal area containing solid wastes with ground water or adjacent surface water, or by infiltration of water through the buried waste materials.

Biological impairment of surface water would include a discharge of micro-organisms that would create a threat to public health. The rate of waste decomposition under uniform moisture conditions decreases with time. Leachate strength (concentration of organic and mineral constituents) also diminishes with passage of time.

Carbon Dioxide Gas

The major gases produced during decomposition of solid wastes are carbon dioxide and methane. Methane is not soluble in water and thus is not of water pollution significance. Carbon dioxide can be dissolved in water and can cause increased hardness or corrosive conditions. Several studies have been made of gas production from refuse landfills in the Los Angeles area following suspicion that CO_2 dissolving in the ground water degraded the quality of the ground water underlying a disposal area. Sufficient information is not yet available to indicate the specific conditions (size of the disposal area, porosity of underlying soils, proximity to ground water) leading to the absence or presence of this problem.

2. Nuisances[1]:

In addition to possible threat of water pollution, nuisance condition may be created because of disposal of certain wastes to land.

Odors

Offensive odors may be caused by dumping organic materials, such as refuse, into ponded water. Exposed leachate seeping from landfills may also be the source of strong nuisance odors. Normal decomposition of refuse in landfills results in some noticeable odors due to organic acids and certain gases in minute concentrations (methane and carbon dioxide gases are odorless); this type of odor production may be increased by entry of water into the landfill. The landfill gas odor problem can be controlled effectively by maintaining the covering of soil over the refuse.

Methane Gas

Another form of nuisance is methane gas. The flamability of methane constitutes an explosion hazard if the gas is allowed to accumulate in closed spaces. Few actual cases of damage due to explosion of landfill gases are on record; however, as the use of barriers at landfills increases and the natural ventilation patterns for the gases are changed, chances are greater for hazardous situations to occur. Buildings located on or adjacent to a landfill might be threatened with an explosion hazard (lateral gas migration through shallow soil has been measured over 600 feet from a landfill in porous soils). This hazard meets the definition of "nuisance" in Water Code Section 13050 (m) since it occurs during or as a result of the disposal of wastes; methane gas controls therefore may be required by the regional board where deemed necessary.

3. Control Measures[1]:

Operations utilized for waste disposal to land must be adapted to the type of waste and the site topography. For example, liquids commonly are ponded or they may be spread over the soil surface to enhance evaporation or allow mixing with the soil. Solid wastes may be disposed of by filling depressions or canyons or by excavation of trenches for burial of the wastes.

Water pollution control devices must be tailored to the type of waste and to the configuration of the disposal site. For example, leachate collection measures for a solid waste disposal area in a pit might include a barrier placed under the base of the landfill with the barrier sloped to a collection sump. Such barriers need to be extended upward on the sidewalls to create a basin underlying the wastes. Provision will have to be made to monitor for the buildup of leachate above the barrier and to allow removal of the leachate if excessive amounts are generated.

It is virtually impossible to prevent all infiltration of water through the surface of a landfill which contains decomposable wastes. A two-or three-foot thick soil layer can become deformed through uneven consolidation and settlement of the buried solid wastes, resulting in formation of cracks in the landfill cover and disruption of the original grading established for surface drainage purposes. Cracking, erosion and settlement can be combated through regularly scheduled maintenance. The greatest attention will be necessary during the early stages of the landfill life. Infiltration can be lessened by placing a greater depth of soil over the landfill; however, the economic feasibility of a landfill may be nullified if greater than three to five feet of soil cover is used unless abundant amounts of the proper soil are available at close proximity to the landfill.

Most landfills are kept relatively dry during disposal operations. The buried solid wastes are thereby stored underground, creating a situation where occurrence of decomposition or leaching processes only have been delayed. These processes await the addition of moisture. This addition may be caused after completion of disposal operations by lack of drainage control or by water applied to the property during subsequent use.

Increasing attention is being given to providing leachate collection systems at landfills coupled with controlled addition of water to accelerate the stabilization of the landfill. Since insufficient knowledge exists regarding the quantity of water necessary and the time required to remove leachable materials and achieve degradation of organics, such disposal projects are regarded to be test situations. For these operations, decomposable wastes should not be placed in water during disposal operations in order to prevent occurrence of odor nuisance problems.

Questions remain to be answered concerning disposal of leachate. Treatment of this high organic and mineral content liquid is difficult. Discharge to a sewerage system usually is not possible because landfills normally are long distances from the nearest connection points. Use of evaporation ponds is practical only if the quantity of leachate collected is less than the evaportation potential of the ponding areas. Recycling of the leachate through a landfill should accelerate the degradation of the organic fraction; however, the conservative mineral salts will be retained within the landfill mass. Some of these salts conceivably may be converted to low solubility compounds. Soluble salts, however, will continue to be susceptible to discharge from the landfill if the leachate volumes exceed the capacity of the barrier underlying the landfill.

Installation of a barrier over the base of a landfill will reduce the natural gas ventilation capabilities. Thus, greater migration of methane gas may be caused in lateral directions leading to hazards of methane gas explosion to nearby structures or oxygen depletion in the root zones of adjacent trees and plants. Placement of a cover material designed to prevent infiltration of rainfall can compound the gas hazard since increased gas concentrations can build up in the landfill. Relief vents should be installed in such cases to allow for greater escape of the gases. These vents are not without problems; the discharge of the gases to the atmosphere may cause odor nuisances.

Possible control measures for carbon dioxide gas are not well defined. Uncertainty exists regarding when such control is or is not necessary since the threats presented by carbon dioxide gas to ground water quality are not totally understood. These threats would be based upon the size and depth of the landfill, rate of gas production from the decomposing organics, type of soil materials, depth to ground water, and quality of ground water. Since the gas molecules are of an order of 100 times smaller than the pores in fine grain soils, such as clay, dry soil is not an effective barrier to carbon dioxide gas movement. Installation of barriers at landfills fabricated from plastic or rubber sheeting does not appear very practical due to the problems of installation and subsequent operation of the landfill equipment over these relatively fragile barriers. Almost no experience exists with use of an effective carbon dioxide gas barrier at a full scale landfill. The most technically feasible gas controls appear to be a moist or wet clay layer, fiber reinforced asphalt or venting of the gases by mechanical withdrawal.

4. Location of Land Disposal Sites[2]:

"Land-based waste disposal systems should be located as far away from and as far downstream of surface water resources as possible. It may be possible in many cases to locate land-based waste disposal sites closer to surface water resources provided that engineering safeguards are included in the design of facilities."

Those areas in the San Francisco Bay Region which receive less than 20 inches of mean annual precipitation have been determined to be the most suitable for land-based waste disposal sites. Areas receiving 20 to 30 inches have a moderate to good suitability rating.

With respect to ground water resources, any area which is within 1,000 feet of a major ground water recharge basin is unsuitable for a land disposal site. Areas in which the depth to ground water from the land surface is less than 10 feet are also unsuitable.

> "Depth-to-ground water criteria should be based upon the depth-to-the-seasonal high level of the saturated zone (water table). In much of the bay region, the water table is not accurately defined by the level at which water stands in wells. In many cases, the water level in wells is either above or below the water table because of upward or downward components of ground water flow."

SOURCES:

1. State Water Resources Control Board, Waste Discharge Requirements for Waste Disposal to Land, Disposal Site Design and Operation Information (April, 1974), pp. 2-5.

2. W. G. Hines, U. S. Geological Survey, Evaluating Pollution Potential of Land-Based Waste Disposal, Santa Clara County, California, Water Resources Investigations 31-73 (1973), pp. 14-15.

TABLE IV-4--*Preliminary suitability evaluation of proposed land-based waste-disposal sites*
[0, unsuitable; 1, poor suitability; 2, moderate to good suitability, 3, most suitable]

Criteria for consideration	Numerical suitability ratings for land-based waste-disposal site				Comment
	Septic tanks	Solid-waste landfills	Wastewater-spray irrigation	Waste-containment ponds	
Land resources and land use[1]					Septic tanks may be the only possible method of domestic wastewater treatment in isolated recreational areas. In some locations parks and recreational areas can be reclaimed from land previously used as a landfill. Small-scale spray irrigation systems may be feasible under controlled conditions for parks, golf courses, and other vegetated areas.
a. Urban	0-1	0	0	0	
b. Parks, campgrounds, game preserves, and large recreational areas.	*1	*0	*1	0	
c. Marshlands	0	0	0	0	
d. Agricultural	1-3	1	3	1-2	
e. Open space	3	3	3	3	
Land slope[1]					Slopes greater than 15 percent can be built upon only with great precaution.
a. 0 to 5 percent	3	3	3	3	
b. 5 to 15 percent	1-2	1-2	1-2	1-2	
c. Greater than 15 percent	0	0	0	0	
Floods[1] Within flood-prone areas (100-year flood).	0	0	0	0	Normally, flood-prone-area mapping for the bay region is based upon a flood with a theoretical recurrence interval of 100 years corrected for present-day flood-control facilities.
Surface-water resources[1]					Land-based waste-disposal systems should be located as far away from and as far downstream of surface-water resources as possible. It may be possible in many cases to locate land-based waste-disposal sites closer to surface-water resources provided that engineering safeguards are included in the design of facilities.
a. Within 1,000 ft of major domestic water-supply reservoir, lake, or stream.	0	0	0	0	
b. Within 500 ft of major tidal water or reservoir, lake, or stream utilized for recreation or non-domestic water supply.	0	0	0	0	
c. Within immediate peripheral watershed[2] of major water-supply or recreational reservoir, lake, or stream.	0-1	0-1	0-1	0-1	
Precipitation[1] (mean annual)					Precipitation criteria presented here applies to the San Fancisco Bay region. For detailed evaluation, a proposed site should be studied to determine expected monthly or weekly rainfall and evaporation rates. The difference between rainfall and evaporation can be used to estimate possible quantities of leachate production in landfills or overloading of septic tank fields.
a. Greater than 50 inches	0	0	0	0	
b. 30 to 50 inches	1	1	1	1	
c. 20 to 30 inches	2	2	2	2	
d. 0 to 20 inches	3	3	3	3	

TABLE IV-4--*Preliminary suitability evaluation of proposed land-based waste-disposal sites* (0, unsuitable; 1, poor suitability; 2, moderate to good suitability, 3, most suitable) (Continued)

6. Ground-water resources[3]					Depth-to-ground-water criteria should be based upon the depth-to-the-seasonal high level of the saturated zone (water table). In much of the bay region, the water table is not accurately defined by the level at which water stands in wells. In many cases, the water level in wells is either above or below the water table because of upward or downward components of ground-water flow. Planners involved in site evaluations should consult with ground-water geologists or hydrologists who have knowledge of the area in questio[n]
a. Within 1,000 ft of major ground-water recharge basin.	0	0	0	0	
Depth to ground water from land surface.*					
b. 0 to 10 ft	0	0	0	0	
c. 10 to 50 ft	1	1	1	1	
d. 50 to 100 ft	2	2	2	2	
e. Greater than 100 feet	3	3	3	3	
7. Soil permeability[3 4]					Desired permeability range for wastewater spray irrigation depends upon whether the system is designed for infiltration or overland runoff. Permeability data always should be examined in conjunction with depth-to-water data to preclude ground-water pollution in areas where wastes are applied to high permeability soils.
a. 0 to 0.2 in/hr	0	3	*	3	
b. 0.2 to 0.63 in/hr	1-2	1-2	*	1-2	
c. 0.63 to 2.0 in/hr	2-3	0-1	*	0-1	
d. Greater than 2.0 in/hr	3	0	*	0	
8. Erosion[3] Within area of active landsliding, gullying or obvious surface instability	0	0	0	0	Planners should be aware that even limited vegetation removal or construction in the bay region can initiate erosion problems.
9. Geology[3] Bedrock or impermeable deposits exposed or near land surface.	0	*0	0	*0	Solid-waste landfills and waste-containment ponds can be located on level impermeable bedrock if diked and properly designed for collection and treatment of leachate.
10. Earthquakes[3] Areas peripheral to active faults and areas underlain by unconsolidated deposits susceptible to severe shaking.	0	0	0	0	Any part of a land-based waste-disposal facility requiring pipelines, holding ponds, or treatment works should be examined with regard to earthquake susceptibility.

[1]Criteria for land resources and land use, land slope, floods, surface-water resources, and precipitation usually can be evaluated first because data normally are available.

[2]See glossary.

[3]Criteria for ground-water resources, soil permeability, erosion, geology, and earthquakes usually are not adequately described by available data. These criteria usually need be evaluated only for sites not eliminated on the basis of criteria in footnote 1.

[4]Soils are often not homogeneous in character with respect to depth or horizontal extent. Therefore, soil permeability rates obtained from existing soils maps should be verified with field data before final site selection.

*See comment column.

SOURCE: "Evaluating Pollution Potential of Land-Based Waste Disposal, Santa Clara County, California," by W. G. Hines, 1973, (Water Resources Investigation 31-73). Twenty-one page text and two map sheets, scale is 1:62,500.

Map of "Selected Physical Information for Alameda County, California," is available for review at the Alameda County Planning Department, 399 Elmhurst Street, Hayward, California.

V. EVALUATION OF SOLID WASTE MANAGEMENT TECHNOLOGY

A. INTRODUCTION

The state of current solid waste management technology is balanced between the proven experience of landfill disposal and the need to recover the resources which are being lost under existing solid waste management practices. Landfill is relatively simple to accomplish, highly reliable, insensitive to market conditions, and the least cost to the consumer. In contrast, resource recovery machinery is technically sophisticated, sometimes unreliable, and intertwined in complicated economic relationships. Nevertheless, it is increasingly recognized from both environmental, economic and legal perspectives that resource recovery is necessary, possible and wise in spite of its problems.

The purpose of this section is to review the types of processes currently available for handling solid wastes generated in urban and metropolitan areas. The "sanitary landfill" will be included and described as one system alternative since, in any process which may be selected, some residue will remain for land disposal. While the technology of landfilling is discussed, it is by no means suggested that this process will continue to prevail as it has in the past. Several of the advanced energy or materials recovery systems are presented; most of the processes are still in some stage of research and development.

Each element of the waste management system (storage, collection, short haul transport, transfer stations, processing stations, and landfill) is discussed. In addition, a long haul element must be considered here since future landfills will be located away from central urban or metropolitan areas. Each element may be broken down into several or many components. In this report each component currently thought to apply to modern systems is noted. Component costs have been identified as closely as current market conditions will allow. Finally, the complexity of the waste system on a Countywide basis suggests several configurations or alternative routes which may be selected for implementation. The concluding section of this report contains the design of those alternative systems selected by the Solid Waste Management Plan Technical Advisory Committee.

B. GENERAL PROCESSES

1. Collection Systems:

The high cost of solid waste collection, estimated variously between 80% to 90% of the total cost of solid waste management, is because it is generally labor intensive. Attempts to reduce the cost of collection have been directed at raising the productivity of the labor through either 1) allowing labor to handle more refuse or 2) substituting a machine for some of the labor. For many reasons, major technical innovations have not been widely accepted. Instead, changes have been mainly directed towards increased safety for labor and mechanical lifting systems for larger containers.

The centralized, mechanized approach using screwdrive, conveyors or vacuum pneumatic have been tried in a few places. The centralized collection system, using the same principle as the sanitary sewer, has a high initial installation cost but low operating cost and appears at this time to have limited applicability.

Innovations in conventional collection methods may be in storage container design, pick up system, and pick up vehicle. The three system elements are inter-dependent because they must work together. The prime objective of innovations is handling nearly all of these time reductions. Many systems utilize some type of hydraulically operated arm attached to the collection truck. Drawbacks relate mainly to mechanical limitations of the system.

Two mechanized collection systems both utilizing truck power to assist the loading of a larger container are the front end loader (FEL) and drop box systems. The smaller FEL containers range from 1½ to 8 cubic yards. Mechanized collection systems such as these are used to collect refuse from high volume multiple residence, commercial and industrial customers. A compaction mode is frequently added to these basic systems to extend the capability of the basic equipment.

The most commonly used collection system is the packer truck, so named because the refuse is compacted within the truck by a hydraulic system and is accepted because of the high cost of backyard collection. Packer truck collection is expensive because of labor and the relatively low efficiency; however, the use of the laborer's transfer container prevents large cost increase. Efficiency of a packer truck permits fill and unload of up to five tons per load, twice per day.

The following table summarizes the technologies used in the systems as described on the previous page:

	System	System Technology	Capacity
1.	Packer Truck	. Transfer container . Manual lift and carry . Power compaction	50 gallons
2.	Drop Box	. Larger container possible . Standardized container . Power loading system . (Power compaction)	14 - 50 cubic yards
3.	Front End Loader	. Larger container possible . Standardized container . (Manually roll container into position) . Power loading system . (Power compaction)	$1\frac{1}{2}$ - 8 cubic yards
4.	Central	. Power conveyors . Either system 2 or 3	Various

(Parentheses indicate functions/technologies which may not always be used).

Source: Alameda County Planning Department

2. Source Separation and Recycling:

An alternative to the use of machines to separate solid waste into component materials is source separation and recycling. These methods have been in use long before front end separation machinery was invented and seem likely to be included in future plans as well. The essential feature of the source separation and recycling methods of sorting wastes is the use of a substantial amount of consumer or volunteer labor.

Source separation is accomplished where the waste is created; in the home, or the industrial plant, for example, where the wastes are manually sorted into as many like categories as are useful. There may be a need for processing the sorted materials - such as baling the paper or shredding or crushing the cans and bottles. Varying degrees of foreign material can be tolerated.

The difficulties with source separation lie in motivating the individual people and groups to perform the separation tasks. Laws, community spirit, and the profit motive, are acceptable sanctions which work. Source separation systems generally involve longer periods between pickup than regular combined collection systems making adequate storage space a requirement which frequently may not be attainable. Sanitation can also be a difficulty. A problem in sorting wastes not unique to source separation is identifying and distinguishing apparently similar materials which are actually different. Public education programs and vivid identification of packaging materials aid in accomplishing separation of the materials.

Some final sorting of materials may be necessary at the central receiving point serving an area. This may include magnetic separation of metal cans, separation of glass by color, shredding, baling or some other treatment.

Recycling connotes the total reprocessing of a source separated material such as the melting of a glass container to re-mold a new container. Another technique for preventing a material from becoming waste is source separation and <u>reuse</u>. This technique has had considerable success with the soft drink and malt beverage container industries although the success has been waning over the last five to ten years due to inroads in this market by nonrefillable containers. Several attempts have been made to (re)institute the refillable (reuseable) container. Other attempts are being made to reuse new types of containers, such as wine bottles.

3. Refuse Transfer Stations and Rail Haul[1]

Transfer stations may be desirable when the distance or travel time from collection to disposal sites is great. Transfer is justified when it saves more in collection costs than transfer itself costs. Daily and seasonal variations in solid wastes delivery rates must be recognized in transfer system design and cost. Good engineering studies will determine the economics of the best design.

There are two basic transfer station designs: those which load solid wastes directly into the long-haul vehicle and those which deposit wastes into a storage area before loading them into the long-haul trailer. Efficiency is gained when solid wastes are compacted into the transfer vehicle. Since compaction of almost any kind increases transportation efficiency, any additional compaction obtained at the transfer stations is probably worth the cost. Once the trailers are loaded, they are transported to the processing or disposal site. No solid wastes should remain at the transfer station at the end of the working day.

If the area served is large or has established several disposal sites, it may be helpful to have more than one transfer station location to shorten travel by collection vehicles. The City of Seattle has two large stations; King County has seven smaller, strategically located stations.

Other methods of transporting solid wastes include railcars, pipes, and barges. Rail transport is being tested by the American Public Works Association (APWA) to determine its cost, advantages, and disadvantages. Barge transport is used in some communities with waterways. Experiments are also underway to develop pneumatic and flushing systems to transport solid wastes.

a. Transfer Station, Orange County, California

Orange County officials use three criteria in determining the cost of transfer: (1) the cost of haul to the transfer station; (2) the unit cost of operating, maintaining, and amortizing the transfer station and its facilities; and (3) the unit cost of transportation from the transfer station to the nearest landfill. Based on the Road Department's 1957 report, "Master Plan for Refuse Disposal," which discussed solid wastes facility needs, the Orange County Board of Supervisors decided that a series of transfer stations and landfill operation would provide the most economical solid wastes disposal system.

[1]Guidelines for Local Government on Solid Waste Management, EPA Publication Number SW - 17c, 1971, pages 77 - 78.

By 1968, Orange County operated three transfer stations geographically located in urban areas, handling about 1,700 tons of solid wastes daily.

Each station has the same basic design, consisting of a ground-level unloading dock, scale system, and fueling area. The dock, 146 feet long and 80 feet wide, has depressed ramps for the transfer trailers adjacent to the unloading dock. This area has space for four sets (a semi-trailer and pull trailer) of transfer trailers to be loaded at a time. Solid wastes from municipalities, private contractors, and commercial operators are weighed on a truck scale as each load is brought into the dock. Typical transfer station equipment consists of truck-tractors, transfer trailers, packer-loaders, and a power broom. The function of the truck and trailer unit is to transport the solid wastes to one of the five county-operated sanitary landfills. The packer-loader (a grab bucket and mounted crane) is used to distribute and compact solid wastes in the transfer trailer, and the power broom (a street sweeper) is used to pick up any solid wastes which might be scattered during the transfer of solid wastes from the collection vehicles to the transfer trailers. When loaded, each truck pulls two trailers carrying nearly 22 tons of solid wastes.

Because the transfer stations are relatively near residential areas, each station has been landscaped with pine trees to make it attractive.

In 1961, the county Road Department re-examined the economics of transfer stations and concluded that transfer had remained economical even though labor and equipment costs had risen. Orange County considers its three transfer stations an essential part of its areawide solid wastes disposal program.

C. <u>FRONT END SYSTEMS</u>

1. Materials Recovery Processes:

a. "Front End" Separation Processes

Most of the energy recovery processes presented in this report use a "front end" separation system - designed primarily to recover specific materials from the solid waste input and to prepare the waste for the particular energy recovery process. "Front end" systems are generally the most technologically advanced components in solid waste management systems.

A system would usually be built up from a number of different "front end" separators. Equipment would vary depending on other requirements of the system such as incineration requirements and local markets for recovered materials. Included herein is a list of most of the components of "front end" separation systems; selected components would thus be combined as in the flow diagram which follows to build a total system for recovering materials. The capital letters in the list of components correlates with the letters in the flow diagram.

The "front end" separation process can be broken down into three sub-processes: preparation, processing and actual sorting. Preparation consists of weighing the refuse for monitoring purposes and manually removing any objects in the refuse which are not compatible with the system. Processing is necessary so that the materials in the refuse get mixed together and are of uniform size. The shredder mixes and chops the refuse to provide a relatively homogeneous input to the rest of the system for sorting. The sorting machines separate single materials according to the unique properties of the material from the main stream of refuse. For example, ferrous metals are sorted from the main stream of refuse by utilizing their unique property of being magnetic. Similarly, other materials are separated by testing for one of these unique properties:

- size to weight ratio or density
- magnetism
- size
- electrostatic properties
- color (reflectivity)

Sorting materials "blindfolded" like this is tricky and several feedback loops are incorporated to purify the output.

MATERIALS RECOVERY SYSTEM[1]

Module I

A: Truck Scale. Packer trucks weigh in and out on a platform scale. Each truck driver receives a punched ticket on entering and turns in the ticket to be punched on leaving.

[1] Material Recovery System, Engineering Feasibility Study, National Center for Resource Recovery, December 1972, pages 3-4 through 3-14.

This step is to keep track of daily tonnage, truck movements, etc. In very large volume facilities, two scales would be required; one for incoming and another for outgoing trucks. However, at a 500 TPD plant, one scale is sufficient.

B: Picking Conveyor. Refuse is moved from the pit--the discharge point for the packer trucks--on a series of conveyors. One conveyor is horizontal and is located so that materials shake loose and spread out. At this point, pickers pull off bundled newspaper, other concentrations of paper, corrugated material, certain metallics and perhaps some white goods, e.g., stoves, refrigerators, etc. Paper goes to a baler; white goods and heavy metallics (Byproduct VII) are classified and stored for removal to another site; the mainstream of refuse goes to shredder (D).

C: Paper Baler. Picked paper and corrugated are baled and temporarily stored ready to be trucked away to recycle use point (Output 2).

D: Shredder. Mainstream flow enters shredder. Rotating hammers chop materials into particles of a nominal four-inch size.

E: Air Classifier. Shredded material enters surge hopper for feed to airlock of classifier. At a uniform feed rate, shredded material is fed into the upward moving air current; this results in fluidization of materials. Pieces of light density are carried up and out of the classifier; high density objects and fragments fall into a collection chamber. Outgoing light materials consist of paper, very fine glass, dirt, film, foil, and light plastics. Heavies, chiefly metals and glass, but including some dense paper and plastic products, are conveyed away from the collection chamber for further processing. Fine dust particles are collected separately (Byproduct II) from the exhaust air stream and dropped into tote bins.

F: Compactor. Light fraction from air classifier is force-fed into transfer trucks for transporting to point of disposal. This is Output I.

G: Magnetic Separator. Heavy fraction from the air classifier is carried on a conveyor beneath a magnetic belt separator suspended over the conveyor head pulley. As the material goes off the end of the converyor, magnetic materials--cans, ornaments, etc.--are pulled away from the non-magnetics and are carried by the magnetic belt to a drop point while the mainstream continued to the rising current classifier.

H: <u>Air Knife</u>. The magnetic fraction from the separator falls through an air jet with a horizontal vector. Bulky, thin-walled items blow out of the drop path into a collector chute. High bulk density pieces continue to a receptacle. Thus, cans are separated from iron bars, etc. All ferrous materials--heavy and light--are classified as Output 3.

I: <u>Rising Current Classifier</u>. Mainstream heavies, still contaminated with food and paper, but relatively ferrous-free, are dispersed in a first pass through a counter current water flow. Floating components include:

paper
food waste
yard waste
plastic
wood
aluminum cans with entrapped air
grease contaminants

Sinking components will be composed of metals, stones, glass, heavy plastic, rubber, or anything with a specific gravity greater than approximately 1.4.

J: <u>Secondary Shredder</u>. Float materials from the rising current classifier are transferred to a small shredder where they are further reduced to a maximum piece size of two inches.

K: <u>Rising Current Classifier</u>. Materials leaving the secondary shredder are again subjected to the rising water classification. The classifier has two compartments so there is no commingling between Step I and Step K. Water flow rate is the same as that of Step I. Float materials, chiefly containing organic materials, are sent out of the process as sludge (Byproduct III). Secondary sinks, rich in aluminum, join the primary sinks from Unit Operation K.

L: <u>Three Deck Screen</u>. Sinks from Unit Operation I and K are screened and thoroughly washed with water sprays into four particle-size fractions with the flow directions as shown on the following page.

Size of Screened Material	Direction
Over 2"	Return to Unit Operation J, Secondary Shredder
2" x 3/16"	To Heavy Media Separator M
3/16" x 20 mesh	Byproducts IV tote bin. This stream will be rich in fine glass.
Minus 20 mesh	Water and solids go to water treatment (U)

This completes Module I.

Module II

M: Heavy Media Separator (2.0 Sp. Gr.). Mainstream flow of 2" x 3/16" pieces disperses in counter-circulating slurry of specific gravity 2.0; floats (Byproduct V) contain such municipal waste as:

- food
- heavy plastic
- rubber heels
- dirt
- some rock.

M sinks go to Unit Operation N.

N: Heavy Media Separator (3.0 Sp. Gr.). M sinks disperse in counter-circulating slurry of specific gravity 3.0. Sink-float split is made as follows:

+3.0 Sp. Gr. Sink	-3.0 Sp. Gr. Float
Lead	Aluminum
Zinc	Glass
Copper and Brass	Porcelain
Stainless Steel	Rock
Some iron missed in Unit Operation G	

The N sink goes to Unit Operation O (Magnetic Drum Separator); N float moves to Unit Operation P (Thermal Dryer).

M,N: Slurry Recovery. Sinks and floats are separated from media (magnetite and ferrosilicon) on a screen. Water sprays remove residual media. Resulting dilute media is dewatered and sent back to the heavy media sump. Excess dilute slurry goes to water treatment (U).

O: Magnetic Drum Separator. N sinks, having been washed, are fed to a rotating drum magnet. Remaining magnetics are attracted to the drum and stick to it. Nonmagnetics fall from the drum surface as Output 4.

P: Dryer. Floats from Unit Operation N go through a continuous belt dryer where all moisture is removed. The dry material goes to Unit Operation Q.

Q: Four-Deck Shaker Screen. The four decks in order from top to bottom are $1\frac{1}{4}$'', $1\frac{1}{4}$, 5/8'', and 3/16''. Dried solids coming from (P) are fed to the second $1\frac{1}{4}$'' deck. Oversize material (+$1\frac{1}{4}$'') is sent to the Roll Crusher (R) for size reduction. The output from the roll crusher is sent back to the top $1\frac{1}{4}$'' deck. The +$1\frac{1}{4}$'' fraction is Output 6. Once material passes the $1\frac{1}{4}$'' screens, it is sent to electrostatic separation.

R: Roll Crusher. Throughput from Electrostatic Separator (T) is double screened ($1\frac{1}{4}$''; Unit Operation Q) materials flow are fed between adjustable counter-rotating rolls. Glass-rich material of reduced size returns to the Four-Deck Screen (Q) for classification. A summary of the (-$1\frac{1}{4}$'') size fractions and their destinations is presented below:

Size	Destination
$1\frac{1}{4}$'' x 5/8''	Electrostatic Separator (T) Glass fraction to (R) Aluminum to Output 6
5/8'' x 3/16''	Electrostatic Separator (S) Glass to Output 5-5A Aluminum to Output 6
-3/16''	Byproduct VI.

S: Electrostatic Separator (5/8'' x 3/16''). The 5/8'' x 3/16'' fraction from Screen Q feeds through an electrostatic separator which separates the aluminum from the glass due to the great difference in the conductivity. In this way, aluminum is removed from the glass and dirt. Aluminum fraction goes off as Output 6, while the glass is Output 5-5A.

T: Electrostatic Separator (1¼" x 5/8"). The 1¼" x 5/8" fraction from Screen Q is processed as in (S) except that glass (1¼" x 5/8") is rejected and sent to Roll Crusher (R) for size reduction. Aluminum is taken off as a component of Output 6.

This completes Module II.

Module III

U: Water Treatment.

V: Optical Sorter. The glass output (5/8" x 3/16") from electrostatic separator S is sent to a Sortex Opitcal Sorter. Here the clear (flint) glass is separated from the mixed colored glass, producing Output 5-5A.

This completes Module III.

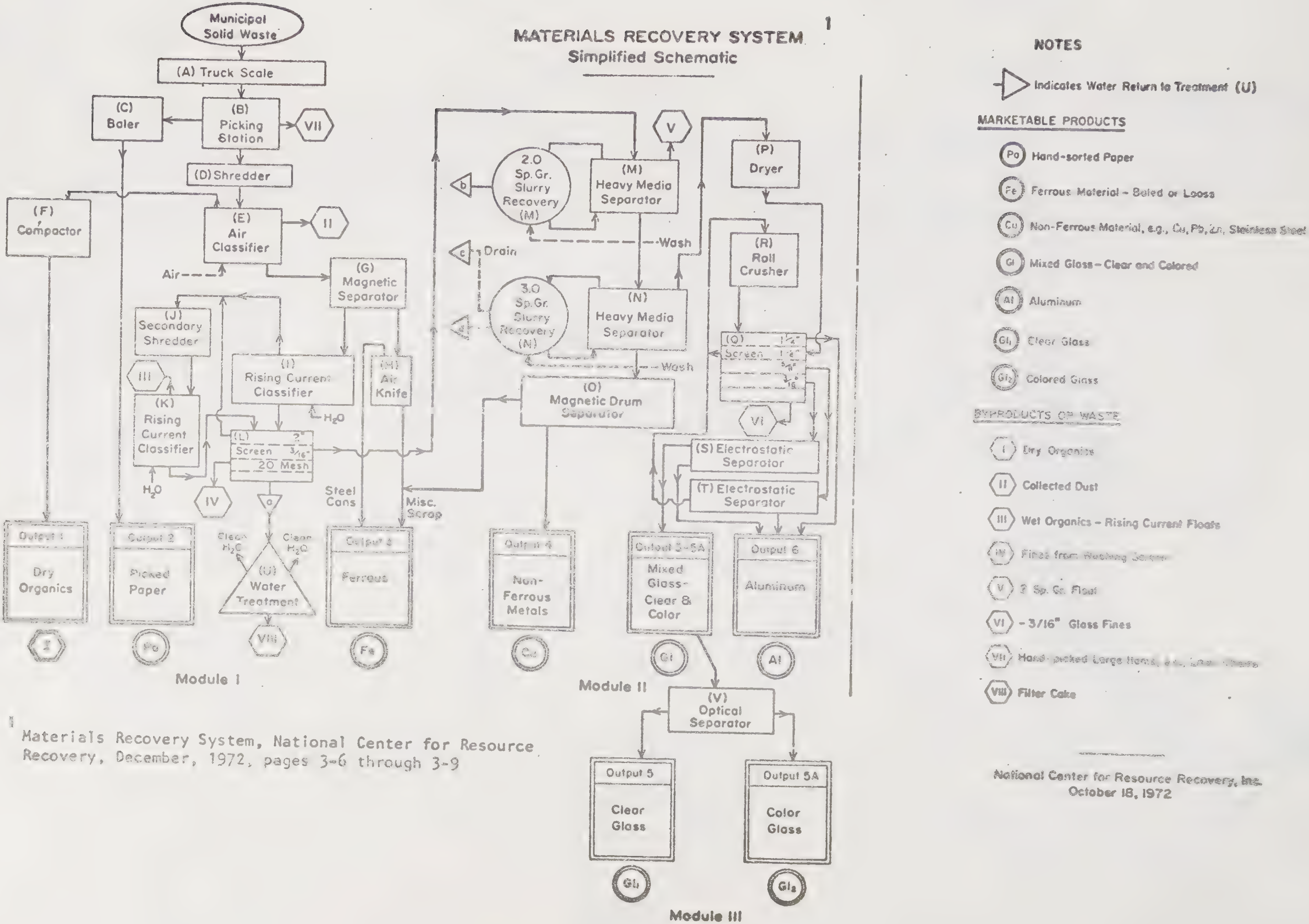
D. RESOURCE RECOVERY PROCESSES

1. Introduction:[1]

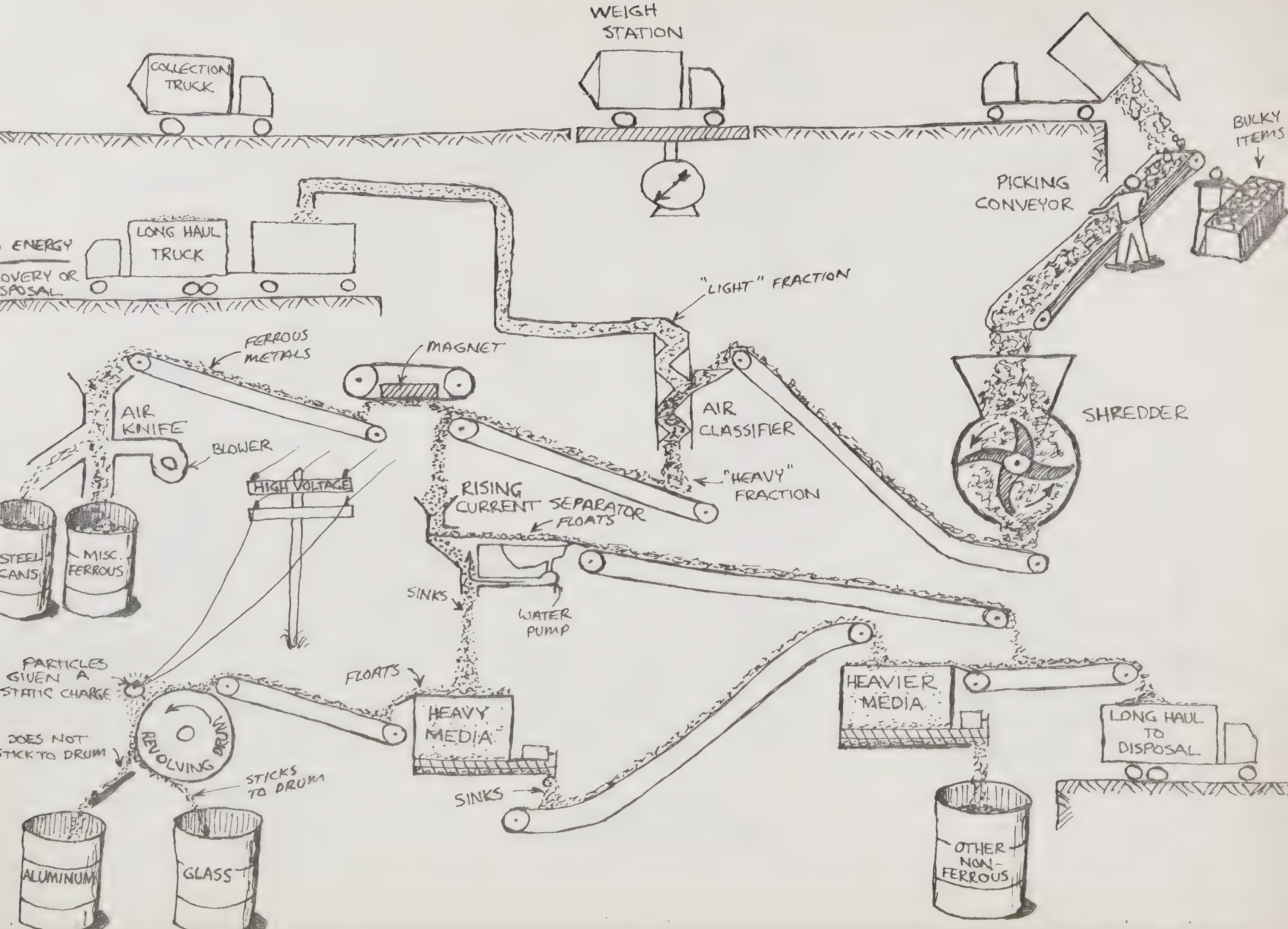
This survey and analysis of the present status of technology for resource recovery from mixed municipal waste shows that the national goal expressed in the Resource Recovery Act of 1970 has been perceived by the government and industry as one worthy of substantial commitment. A significant response has already been in the form of the development of numerous resource recovery processes. On the other hand, the development has been largely unfocused and uneven because the specific technological needs of resource recovery are not yet well defined. We appear, at this point, to have a rather impressive shopping list of technology to choose from, but do not know which system concepts to buy or even whether to buy at all. Part of the problem is that technological development has been focused on processing a "new" raw material stream--mixed municipal waste--but the resulting product output does not necessarily result in something for which there is a ready market.

Technical Summary: Only two methods are currently fully developed and practiced for the recovery of resources from mixed municipal waste--heat recovery from incinerators and composting. Heat recovery from incinerators has been practiced in Europe and Japan for some time. Recently, heat recovery incinerators of European design have been introduced into the U. S. and Canada. Although heat recovery from incinerators has been practiced for some time there are still some significant technical problems with these

[1] Resource Recovery, the State of Technology, Midwest Research Institute, February 1973, pages 1 - 4.



[1] Materials Recovery System, National Center for Resource Recovery, December, 1972, pages 3-6 through 3-9


WEIGH STATION
COLLECTION TRUCK
BULKY ITEMS
PICKING CONVEYOR
LONG HAUL TRUCK
TO ENERGY RECOVERY OR DISPOSAL
"LIGHT" FRACTION
FERROUS METALS
MAGNET
AIR CLASSIFIER
SHREDDER
AIR KNIFE
BLOWER
"HEAVY" FRACTION
HIGH VOLTAGE
RISING CURRENT SEPARATOR
FLOATS
STEEL CANS
MISC. FERROUS
SINKS
WATER PUMP
PARTICLES GIVEN A STATIC CHARGE
FLOATS
HEAVY MEDIA
HEAVIER MEDIA
LONG HAUL TO DISPOSAL
DOES NOT STICK TO DRUM
REVOLVING DRUM
STICKS TO DRUM
SINKS
ALUMINUM
GLASS
OTHER NON-FERROUS

systems such as erosion and corrosion of the boilers and reliable deliverability of the product. The technology of composting is well established. There are several composting techniques, the most successful being the Fairfield-Hardy and the Varro systems. Poor marketability of the finished product has been a factor in a rather unimpressive history of composting in the U. S. A.

There has been a marked increase in the development of new technology for resource recovery from municipal waste during the last few years. Included in this emerging technology are: (1) energy recovery processes, (2) materials recovery processes, (3) pyrolysis processes, and (4) chemical conversion processes.

The emerging energy recovery technology includes fuel recovery processes, steam generation processes, and electrical power generation processes. Energy recovery is applicable only to the organic fraction of wastes, but many of the energy recovery processes also recover some of the inorganics (metals and glass). Two of the promising fuel recovery systems are the Horner-Shifrin and the A. M. Kinney processes. The Horner-Shifrin process involves dry shredding of the refuse and using it as a supplementary fuel in existing power plant furnaces. A. M. Kinney has a design to wet pulp waste organics for use as a supplementary industrial or power plant fuel.

Two new steam generation systems, designed by The American Thermogen Company and Torrax Systems, Inc., involve the recovery of heat from the combustion of refuse in special furnaces. The novel aspect of these systems is the use of high-temperature furnaces which require no preseparation or preparation of the waste, and which melts all of the residue to a lava-like frit.

Another new energy recovery system, called the CPU-400, is designed to burn shredded municipal waste in a high pressure fluid-bed combuster and uses the hot gases to drive a gas turbine-electric generator. This system is presently in the pilot plant development stage.

The materials recovery processes are designed to remove paper, ferrous and nonferrous metals, and glass from the refuse. In most processes all four materials are recovered. Both wet and dry processes have been devised to separate the paper from mixed waste. Techniques to remove the metals both from the mixed waste and from incinerator residues are being developed. Most of the ferrous metal separation techniques are based upon magnetic separation-a well developed technology. The glass is separated by air classifiers (separation by density) and color sorting using optical devices or by flotation techniques.

The materials recovered in these systems are generally of a quality that subsequent refinement or additional upgrading may be necessary to obtain fully marketable products. The most developed materials recovery systems are the Black-Clawson Fibreclaim system, and an incinerator residue recovery system developed by the U. S. Bureau of Mines.

A number of organizations are in the process of developing pyrolysis processes that recover synthetic fuel oil, gas or other potentially valuable materials from municipal wastes. These pyrolysis systems involve the thermal degradation of the waste in a controlled amount of oxygen. Some of the products that have been obtained from municipal waste by pyrolysis systems are oils, gas, tar, acetone, and char. Pyrolysis is an attractive method for waste resource recovery because of the basic flexibility of the technique; changes in operating conditions can be made to vary the nature of the recovered products.

The Garrett Research and Development Company has developed a pyrolysis process that recovers synthetic fuel oil from refuse (glass and ferrous metal are also recovered). The Garrett system appears attractive because of the reported high yield of low sulfur oil and substitutability for low-grade fuel oil. However, it has not yet been determined whether the recovered oil will be readily usable as a substitute for commercial fuel oils. Union Carbide has a high-temperature pyrolysis process from which the combustible off-gases can be cleaned for use as a fuel gas for utility furnaces. The adaptability of the synthetic gas to commercial furnace fuel systems has not been fully determined yet. Monsanto has a pyrolysis system that has been tested to a much greater extent than any of the other pyrolysis systems. Furthermore, their pyrolysis unit is based upon extensive rotary kiln design experience. Both facets speak well for probable success of the Monsanto pyrolysis system. The primary pyrolysis unit (fluid-bed type) proposed by the Hercules Company is feasible, but unproven; their back-up unit is a well-developed furnace for producing wood charcoal. Battelle Northwest and West Virginia University have also been working on the development of pyrolysis processes for mixed municipal wastes.

There are a variety of chemical conversion processes (anaerobic digestion, acid hydrolysis, wet oxidation, hydrogennation, and photodegradation) which have been conceived for mixed municipal waste, resulting in such products as proteins, methane, glucose, sugar, oils, alcohol, yeasts, and other organic chemicals. Since most of these processes utilize only the cellulose portion of the waste, separation and pretreatment of the waste is necessary. Most of these processes are in early stages of development.

Economic Summary: The most obvious finding of our economic analysis is that resource recovery systems are not self-sustaining economic operations under the conditions of the analysis used. They may not recover revenue sufficient to offset total costs; all systems analyzed to show a net cost of operation. However, where incineration, remote landfill, or other high-cost waste disposal is necessary, resource recovery offers an economically viable alternative. Most resource recovery systems show lower costs than conventional incineration (without resource recovery); several have net costs (for large capacity plants) low enough to compete with landfill, if the recovered products can be sold at or above the assumed prices.

Under the conditions used in the generalized economic analysis, the process ranking by lowest net cost is: (1) fuel recovery, (2) materials recovery, (3) pyrolysis, (4) composting, (5) steam generation with incinerator residue recovery, (6) steam recovery, (7) incinerator residue recovery, and (8) electrical energy generation. The net operational costs (based on a 1,000 TPD plant) range from about $3.00/ton for fuel recovery systems to about $9,00/ton for electrical energy generation.

Most of the emerging systems for resource recovery utilize new technology or at least unique combinations of existing industrial technology. Political jurisdictional units are often hesitant to experiment with new or unproven technology since this represents a radical departure from traditional waste management practices and introduces "high risk" of taxpayer funds. This is true even though a system developer may guarantee performance of a specific system. However, in order to introduce technically and ecomically viable disposal/resource recovery systems waste management jurisdictions will be required to adopt relatively sophisticated technology and competitive marketing skills.

Most of the resource recovery systems examined are capital intensive; i.e., a large capital investment is required for each system. Therefore, the fixed costs of operation are quite high in relation to total costs. These systems should be operated at or near capacity to minimize unit costs and maximize salable product output. In addition, the systems show economies of scale so that the larger the system, the more attractive the unit cost of operation.

Perhaps the most critical economic factor is marketability of the output products. All of the resource recovery techniques produce products that must compete with established commodities directly or indirectly in the marketplace. The variables of most importance are: unit price (or value), throughput quantity and the percent of input (or output) that is salable. In turn, these variables are dependent upon the quality of the recovered product

and its applications or demand in the specific situation in which it occurs.

In summary, waste processing for resource recovery requires sophisticated industrial technology and a large capital investment, and must be operated within competitive industrial market conditions. Nonetheless, resource recovery is a viable alternative to traditional waste disposal practices and should be carefully assessed by any municipality or jurisdictional unit faced with a waste disposal investment decision and/or high-cost waste disposal.

a. Supplemental Firing Process[1]

Name of Process:	Horner & Shifrin Fuel Recovery Process
Developed By:	Horner & Shifrin, Inc. 5200 Oakland Avenue St. Louis, Missouri
Sponsored By:	Environmental Protection Agency City of St. Louis Union Electric Company
Development Status:	Demonstration plant in operation since June 1972
Recovered Products:	Fuel and Magnetic metals
Capacity:	Demonstration plant
Input:	650 tons/day (2 shifts)
Output:	Fuel, 600 tons/day; magnetic metals, 50 tons/day

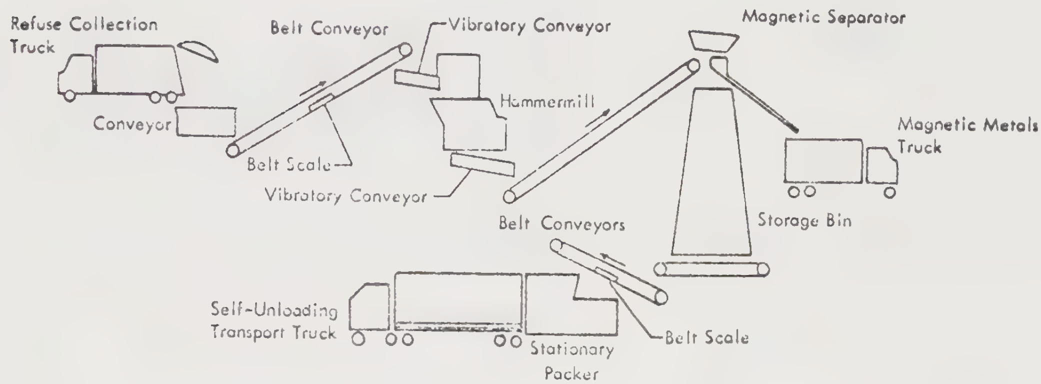
The Horner & Shifrin Fuel Recovery Process converts municipal into a form capable of being injected into an existing utility boiler. The objective is to replace a portion of the coal, oil or gas presently used to fire the boiler with solid waste. Experience has shown that a 10 to 20% mixture by heating value of solid waste (remainder of the primary fuel) is optimum for most existing boilers; although this input is relatively small in heating value, it still represents a large amount of municipal wastes.

Figure "A" (V-1) shows diagrammatically the elements of the initial refuse processing facilities.

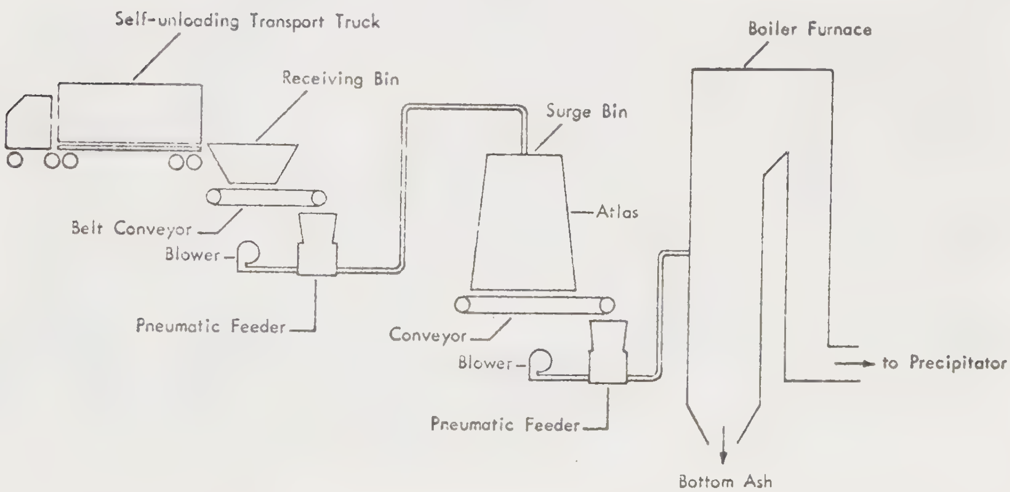
[1] Summarized from Resource Recovery, Catalogue of Processes, Midwest Research Institution, 1973, Pages 5 - 8.

Incoming refuse is weighed and shredded to uniform size before magnetic metals are separated off for recovery. The remainder of the waste is high-density and is loaded onto trucks for transport to the boiler plant, a step which would be unnecessary if the processing and boiler facilities were located at the same site. Figure "B" (V-1) shows the boiler/power plant facilities of the Horner & Shifrin system, where the refuse is conveyed to a surge bin for temporary storage and boiler feed rate modulation. Lastly, the shredded refuse is injected into the boiler at the four corners and burned.

Figure V-1



Horner & Shifrin Fuel Recovery System - (A) Processing Plant



Horner & Shifrin Fuel Recovery System - (B) Power Plant Facilities

Supplemental firing is usually one of the lowest cost alternative methods of resource recovery because it acts as an add-on system to an existing boiler facility. In reality, it is only the existing coal-fired boilers which can take advantage of this opportunity to save costs because only the coal fired boilers are capable of handling the bottom ash and fly ash resulting from solid waste incineration. Oil and gas fired boilers have no capability to remove the bottom ash and only limited capability to clean the exhaust gases.

b. Incineration Process[1]

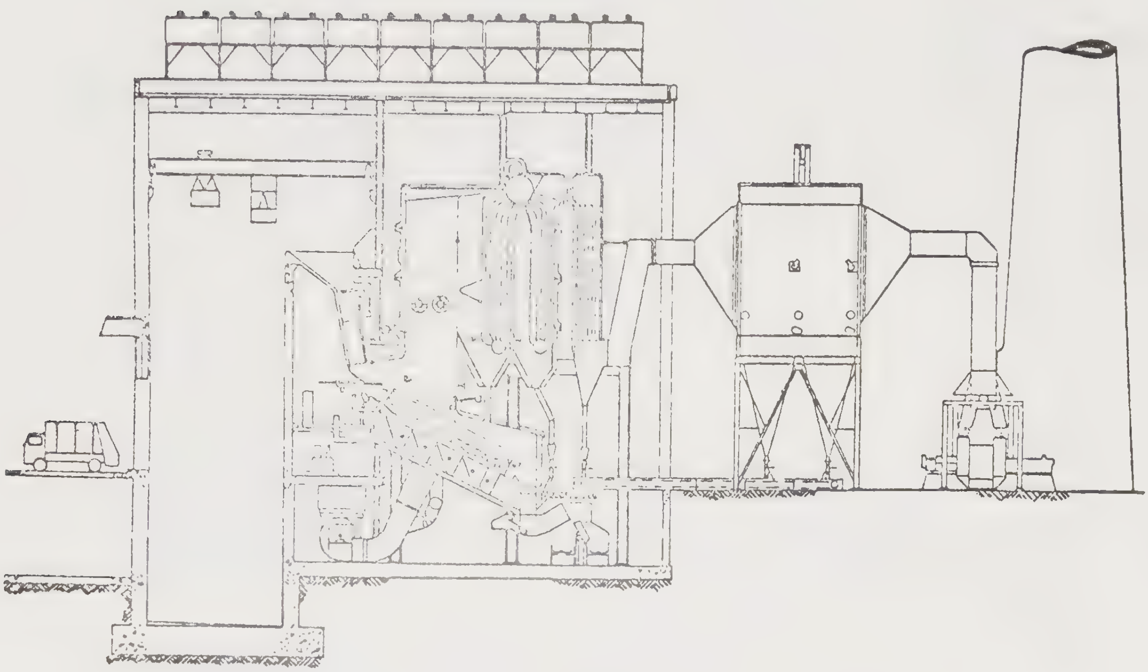
Name of Process:	Chicago Northwest Incinerator
Developed By:	Ovitron Corporation IBW-Martin Incinerator Group East Straudsburg, Pennsylvania 18301
Sponsored By:	City of Chicago, Illinois
Development Status:	Commercial plant in operation since March 1971.
Recovered Products:	Steam and magnetic metals
Capacity:	
Input:	1,600 tons/day
Output:	Steam 440,000 pounds/hour Metals, 85 tons/day

Based on the Martin Incinerator System widely used in Europe, the Chicago Northwest Incinerator is a unique process for disposing of municipal refuse and generating live steam for industrial or power generating purposes. Refuse from collection trucks is dumped into a pit storage area and placed directly into the feed hopper. Hydraulic rams push the refuse from the feed chute onto the inclined reverse reciprocating grate, the heart of the incinerator where the refuse is burned. The grate is continuously moving which allows the refuse to tumble over and burn more completely. Air is forced up through the bars of the grate to aid the combustion. Burning is at high temperature which minimizes post-incineration clean up of exhaust gases. The Chicago Northwest Incinerator uses special high temperature metals lubrication and cooling techniques at certain points in the process.

[1] Ibid, pages 24 - 27.

Heat from the burning refuse is converted to steam in water-walled tubes with extruded fins. The hot gases from the incinerator make several passes through this boiler and a special feature traps a large amount of fly ash. A second section of the boiler recovers additional heat from the incinerated refuse. The hot gases, now cooled to about 450° F, are finally cleaned in an electrostatic precipitator before being exhausted to the atmosphere.[1] The Chicago Northwest system has several provisions so that it may operate continuously, 24 hours per day; most incinerators must be shut down periodically for cleaning and maintenance.

Figure V-2



Chicago Northwest Incinerator

[1] This degree of air pollution control is not sufficient in California; addition pollution control equipment would be required.

c. Incineration Process[2]

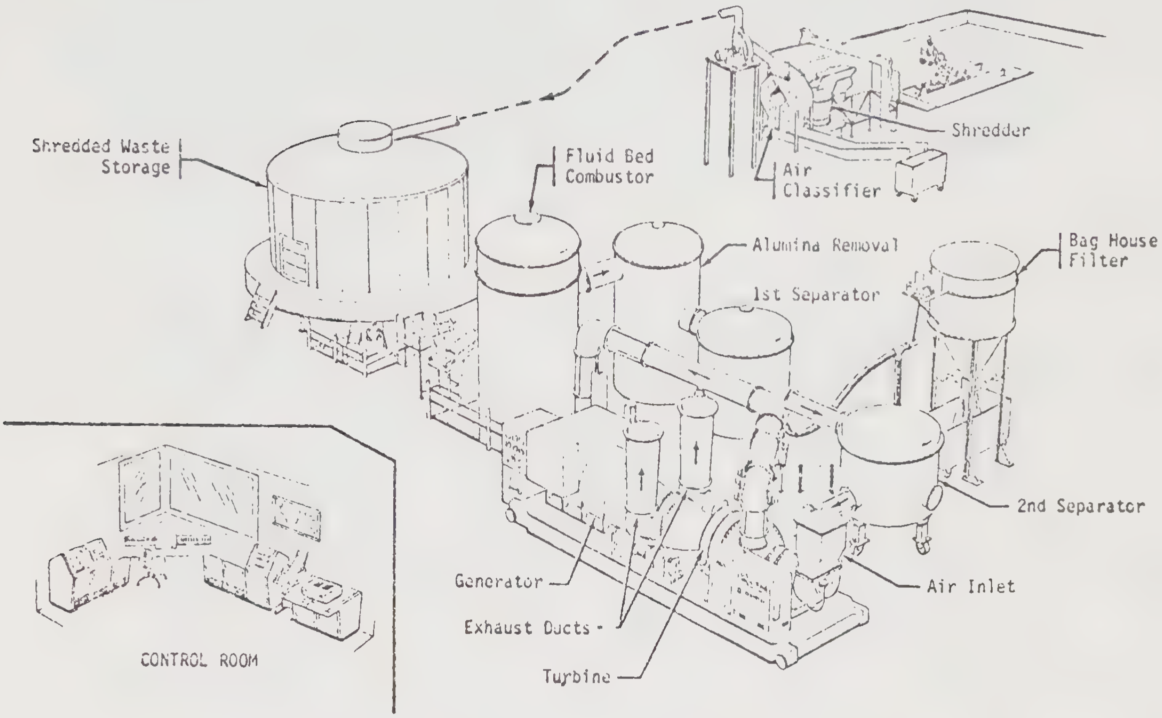
Name of Process:	CPU-400
Developed By:	Combustion Power Company, Inc. 1346 Willow Road Menlo Park, California 94025
Sponsored By:	Environmental Protection Agency
Development Status:	Pilot plant began operation in late 1972.
Recovered Products:	Electricity, ferrous and nonferrous metals, glass, sand, fly ash.
Capacity:	
Input:	Pilot plant, 80 tons/day; commercial plant, 1,000 tons/day
Output:	Based on 1,000 tons/day:

Ferrous metal, 50	Sand, 75
Aluminum, 5	Fly ash, 75
Other metals, 2	Electricity, 17,740 kilowatts
Glass, 30	

The CPU-400 is a system for burning municipal refuse under controlled conditions to drive a gas turbine and electrical generator. Incoming refuse is shredded and air classified to remove the heavy non-combustible fraction. The combustible portion is stored for metering to the incinerator. The incinerator has a bed of sand with a compressor blowing air up through it. As refuse is pneumatically fed into the incineration area, the heated sand becomes fluid and rotates and exposes the refuse for complete combustion. Exhaust gases are cleaned to protect the turbine from deposites and corrosion and then fed to the gas turbine. The turbine shaft is connected to an electric generator. The feed rate of refuse input to the fluid bed incinerator is monitored and controlled by complex electronic equipment to obtain the desired output from the generator.

[2]Resource Recovery, op. cit., pages 12 - 15.

Figure V-3



CPU-400 Pilot Plant

d. Pyrolysis Process[1]

Name of Process:	Oxygen Refuse Converter System (Purox)
Developed By:	Union Carbide Corporation Linde Division Tarrytown, New York
Sponsored By:	Union Carbide Corporation
Development Status:	A pilot plant has been in operation since early 1971
Recovered Products:	Fuel gas and granular slag

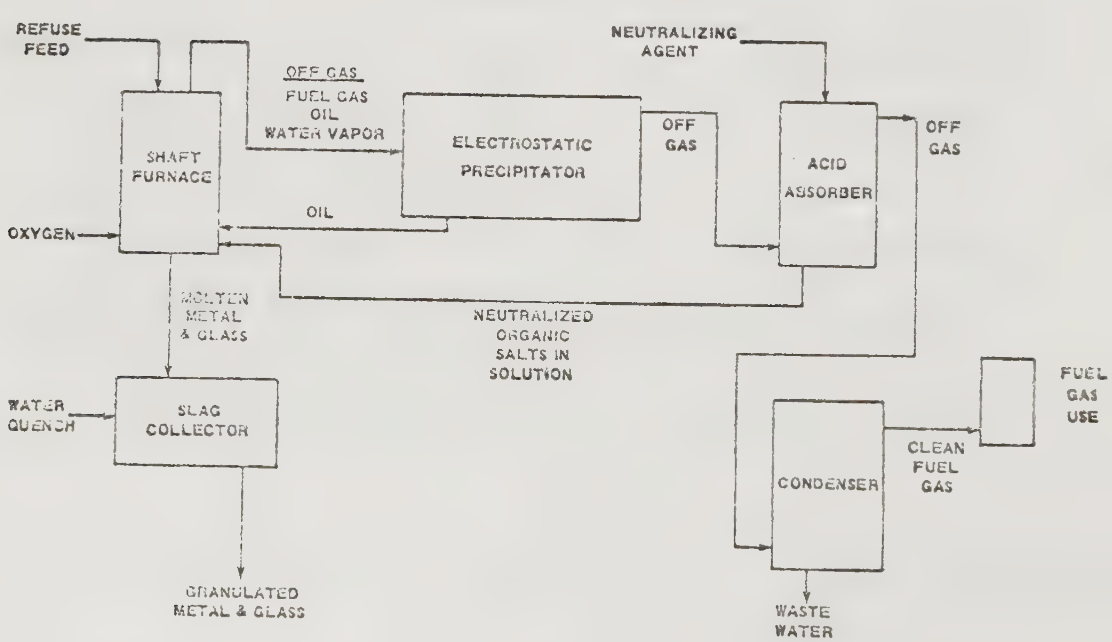
[1] Ibid, pages 98 - 100A.

Capacity:

Input:	Pilot plant - 5 tons/day; proposed demonstration plant - 200 tons/day
Output:	(Based on 200 tons/day input)
	Fuel gas 130-170
	Slag 40

The Union Carbide Purox system is a modular concept with 350 tons per day components. The main component of the system is a verticle shaft furnace which is sealed from the atmosphere. Mixed municipal refuse is fed into the furnace near the top; when in operation, the shaft furnace is full of refuse at all times. In the bottom of the furnace, pure oxygen is continuously injected which reacts with the waste to give off hot gases and a molten slag. The hot gases rise through the refuse in the shaft furnace heating and drying it before this refuse in turn sinks to the bottom where it is thermally broken down. The temperature at the bottom of the furnace is about 3000° F so any part of the refuse that does not oxidize and exit the furnace as a gas becomes a molten lava-like material. This molten material is quenched in water and becomes a frit, like course sand, which can be used for its engineering properties.

Figure V-4



Oxygen Refuse Converter

The hot gases which rise through the refuse in the shaft furnace are the desired output of the system. The particulates, water, and some oils in the gas must be purged by several stages of gas cleaning equipment. The final product gas, has a heating value of about 300 BTU's or 1/3 that of natural gas. This gas may be upgraded to methane gas (heating value equal to natural gas), converted to methanol, an industrial chemical and fuel, or used directly.

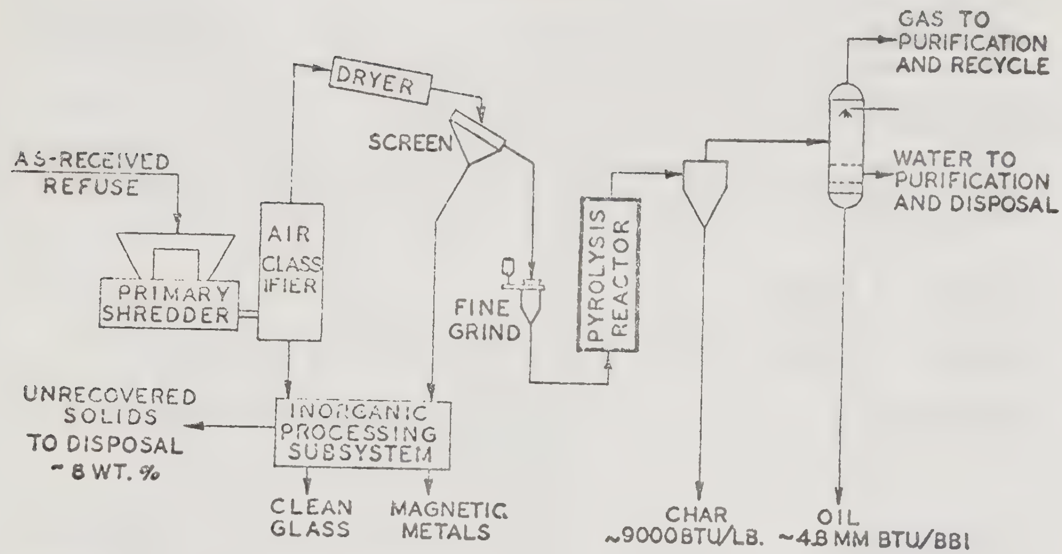
e. Pyrolysis Process[1]

Name of Process:	Garrett Pyrolysis Process
Developed By:	Garrett Research and Development Co. 1855 Carrion Road LaVerne, California 91750
Sponsored By:	Garrett Research and Development Co.
Development Status:	Pilot plant is completed. A demonstration plant is to be built in San Diego County, California
Recovered Products:	Pyrolytic oil, char, glass, and magnetic metals
Capacity:	
Input:	Pilot plant - 2-4 tons/day; demonstration plant - 200 tons/day
Output:	(Based on 2,000 tons/day input) Oil 480 tons/day Char 160 tons/day Glass 120 tons/day Metals 140 tons/day

The Garrett process shreds and air classifies as received refuse to separate the organic portion for pyrolysis from the inorganic glass and metals. The organic fraction is dried and then ground again to a finer size for input to the pyrolysis reactor. Refuse is broken into smaller molecules down in the reactor by intense heat in the absence of oxygen. The products are char, oil, gas and small amounts of waste water. The gas is purified and used within the plant for heating; output products are the char and the oil. Although the "garboil" is a low sulphur oil which is quite desirable with respect to improved emissions to the atmosphere when burned, the oil has shown a tendency to corrode metals.

[1] Ibid, pages 95 - 97.

Figure V-5



Garrett Pyrolysis Process

f. Pyrolysis Process[1]

Name of Process:	Landgard
Developed By:	Monsanto Enviro-Chem Systems, Inc. 800 North Lindbergh Boulevard St. Louis, Missouri 63166
Sponsored By:	Monsanto, EPA
Development Status:	A pilot plant was operated for 2 years. A demonstration plant is to be built in Baltimore, Maryland
Recovered Products:	Steam, char, aggregate, metals
Capacity:	
Input:	Pilot plant - 35 tons/day; demonstration plant - 500 tons/day
Output:	Not available

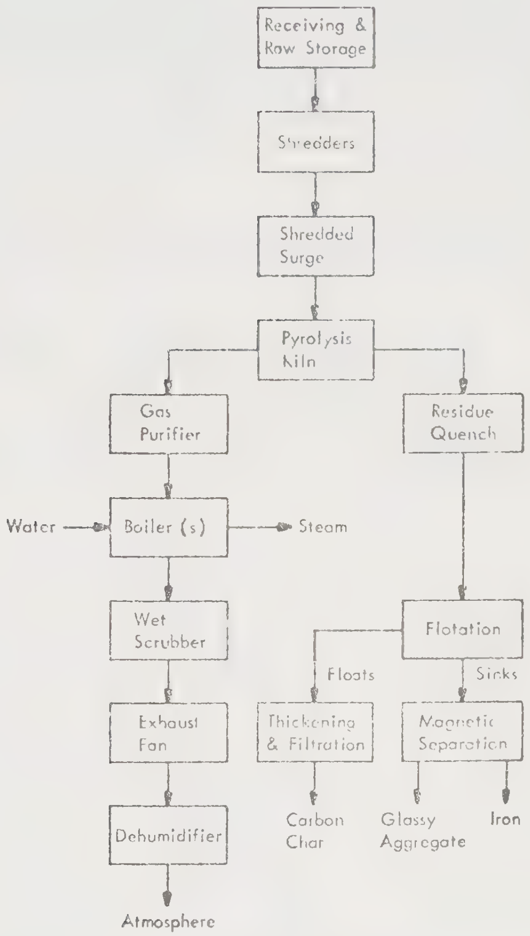
The Landgard pyrolysis system recovers ferrous metals, aggregate, carbon char and steam from municipal solid waste. Incoming wastes are shredded and temporarily stored before feeding into a unique rotary kiln for pyrolyzing. Counter-current flow of glass expose the feed to progressively higher temperatures as it passes through

[1] Ibid, pages 101 - 104.

the kiln, so that first drying and then pyrolysis occurs. The hot molten discharge from the lilk is quenched in water and the floating carbon char is skimmed off. The sink material is separated into ferrous metals and the glassy aggregate residue.

The hot gases from the rotary kiln are used for their heat in a boiler to generate steam. Thereafter, the cooler gases are processed and cleaned to a degree so that they may be safely released to the atmosphere.

Figure V-6



Landgard System

g. Solid Fuel Recovery Process[1]

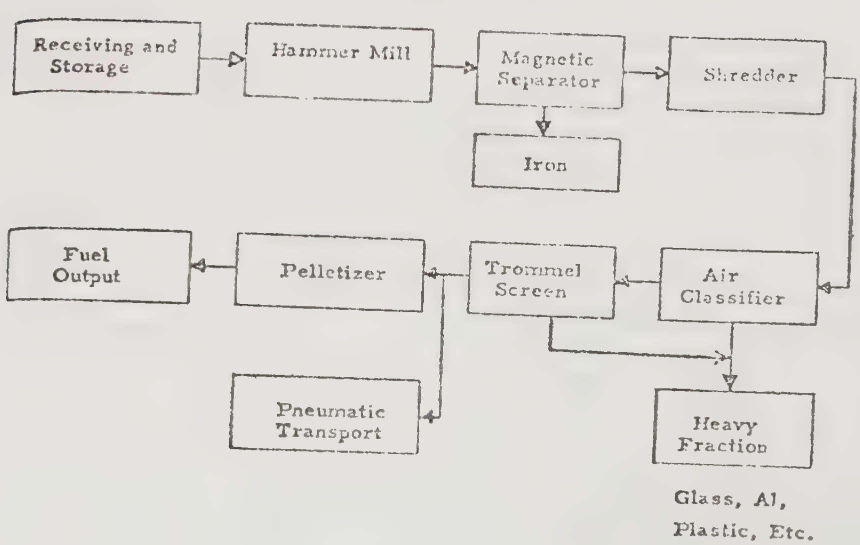
Similar to the supplemental firing concept, a process developed by the Sira Corporation converts solid waste into a 3" - 4" pelletized fuel for burning in a utility boiler. Refuse is first reduced to 4" size by a hammer-mill. Magnetic materials are separated at this point before the material is shredded again to a 2" size. A two stage process consisting of an air classifier and a trommel screen separates the non-combustible glass, aluminum, etc., from the combustible fraction which is to be processed into the fuel. The finished pelletized fuel has a heating value of 7,000 - 7,500 BTU's/pound; coal produces about twice that much heat per pound. The fuel may be transported and handled without unusual problems, but can only be burned in boilers having provisions for both fly and bottom ash.

Figure V-7

FUEL PROPERTIES:

Sulfur	=	Approximately	0.17%
Ash	=	Approximately	10-20%
Moisture	=	Approximately	20-30%
Heating Value	=	Approximately	6000-7000 BTU/lb.
Metallic	=	Trace	

SIRA CORP
FUEL PROCESSING PLANT



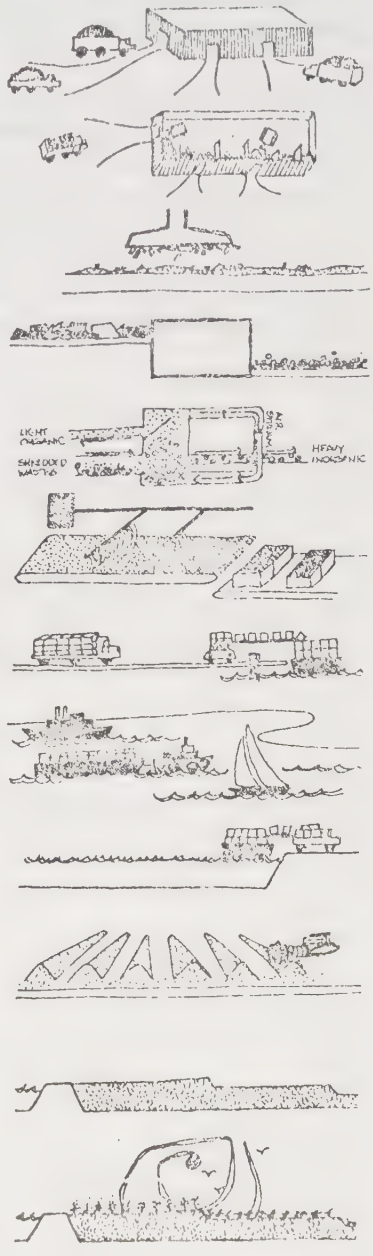
[1]Summarized from report prepared by Diane L. Calden for Gas Resources Board, September, 1973, pages 22 & 23.

h. Composting Process

Figure V-8[1]

A Resource Recovery Plan For The San Francisco Bay Area[1]

The Bay Area need not continue to bury its solid wastes in land fills. Instead, it could start now to recover these resources and put them to beneficial use. The twelve steps involved in such a resource recovery process are the following.......



1. Deliver All Wastes To A Processing-Transfer Station

To the greatest possible extent paper, glass and metals would be kept segregated at their sources and be delivered in separate trucks.

2. Separate Out Directly Usable Materials

Returnable bottles and clean paper would be sorted out for resale and reuse, either directly or after reprocessing, as raw materials for new secondary industries.

3. Remove Ferrous Metals For Sale To Industry

Large ferrous metal objects such as stoves or car bodies would be segregated by hand. Tin cans and other small iron objects would be extracted magnetically.

4. Reduce Particle Size

Materials remaining after the above would be shredded and crushed to reduce all materials to small particles with a maximum dimension of two inches.

5. Separate Organic From Inorganic Materials

The shredded wastes would be passed through an air classifier - a device that uses a rising stream of air to lift the light organic material and leave the heavy inorganic material behind.

6. Blend In Special Wastes

Special organic wastes such as digested sewage sludge, which is high in nitrogen and water content would be blended with the main stream of shredded organic material.

7. Load Organic Wastes On Barge For Transport

Blended wastes, packaged in special containers, would be trucked to the point of embarcation and transfered to barges.

8. Transport Organic Wastes To Delta Island

Containerized organic wastes will be transported by barge from San Francisco Bay through the busy waterways of the Delta to the steadily subsiding Delta Islands.

9. Unload Organic Wastes On Delta Island

Barge unloading operations, being carried on in windy locations, would be carefully designed to minimize the scattering of wind-blown particles as well as the creation of any unsightliness.

10. Compost Organic Wastes

Wastes would be stacked in windrows for aerobic composting with regular turning. Composting would be continued until a stable humus has been produced. High temperatures would prevent fly breeding and rodent attraction.

11. Using Compost, Raise The Land Level Behind The Levees

Compost would be placed on the land behind the levees to a width of 500 feet, each successive layer 1 foot in depth. Each layer of compost would be followed by a layer of suitable dredger spoil and the two thoroughly mixed, to a depth of 20 feet at the levee, terracing downward toward the center of the island.

12. Plant Agricultural Crops On The New Land Surface

The nationwide importance of the entire operation is the demonstration that a soil mantle can be produced using compost, which is the equal of native soil in fertility. Hence, a three to five year period of rotating crops will be demonstrated using normal practices.

[1] Environmental Impact Planning Corporation 319 Eleventh Street San Francisco California [illegible]

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[1] This summary is adapted from <u>Solid Waste Management Implementation Project, Volume 1, Project Report</u>, Association of Bay Area Governments, December, 1973. A revision in the project made in August, 1975, by ABAG moves Step 10, Compost Organic Waste, between Steps 6 and 7.

Composting is defined as the biological decomposition under controlled conditions of the organic constituents of wastes to a humus-like substance. Composting is the most commonly done in the presence of air. The process generates temperatures within the composting material of over 150° F, gives off no odors and is completed in 20 to 30 days.

An example of a project to reclaim the organic fraction of mixed refuse through composting is the San Francisco Planning and Urban Renewal Association's 1971 report "A Solid Wastes Management System for the Bay Region" which is also known as the Bay Delta Plan. This report included a proposal to use the organic portion of municipal refuse for island reclamation in the Sacramento-San Joaquin Delta. The compost material would be utilized for levee stabilization.

[1] Summarized from Solid Waste Management Alternatives, IDS 225 A/B Study Group, U. C. Department of Engineering, June, 1974, page C-22.

E. DISPOSAL

1. Sanitary Landfill[1]:

Sanitary landfill frequently is a versatile and economical disposal method. Almost any solid wastes can be disposed of in a sanitary landfill, and otherwise unusable land can often be reclaimed for community use. Major elements in the sanitary landfill process are proper placing of refuse, effective compaction, and adequate cover. (See Figure V-9).

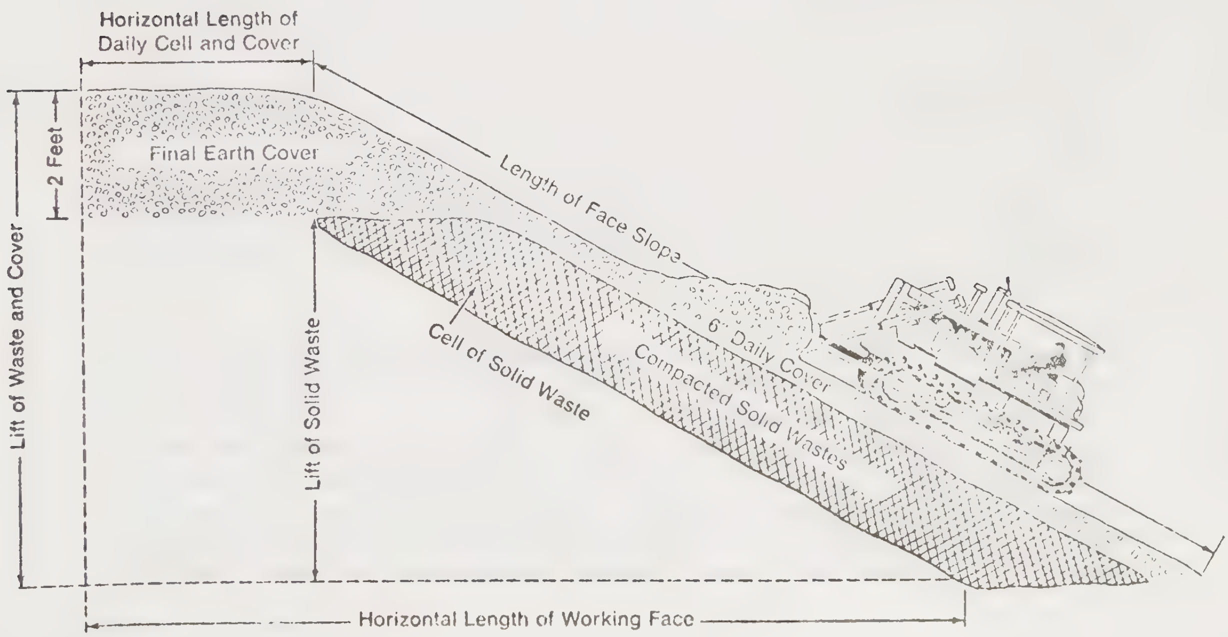
According to the American Society of Civil Engineers:

> Sanitary landfill is a method of disposing of refuse on land without creating nuisances or hazards to public health or safety, but utilizing the principles of engineering, to confine the refuse to the smallest practical area, reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operation, or at such more frequent intervals as may be necessary.

No on-site burning should ever be permitted at a sanitary landfill. A sanitary landfill can be made operational in less time than an incinerator or compost plant.

Figure V-9

sectional view of a sanitary landfill



[1] Guidelines for Local Government on Solid Waste Management, EPA publication number SW - 17c, 1971, pages 78, 79 & 80.

F. ALTERNATIVE SOLID WASTE MANAGEMENT SYSTEMS

1. Flow Diagrams: 1975, 1980 and 1990:

It is now possible to present a description of the combination of various processes which might be implemented in Alameda County. The accompanying flow diagrams show the quantities of municipal wastes (residential, commercial) which are, or will be, collected for disposal during the 1976 to 1990 planning period. Flow diagrams for the 1990 to 2000 planning period will be developed during plan implementation as part of the continuing planning process. Estimates of future quantities of wastes are based upon the quantities which were collected in August, 1973, and hauled to the Davis Street Disposal Site by Oakland Scavenger Company. The flow charts themselves show the combination of alternatives whose implementation would have to accompany the inevitable closing of all of the landfill sites along the margins of the Bay.

Explanation of the difficulty or problems associated with the estimates of waste follows the charts. The systems which are described in the charts are based upon 1973 data for 1975, 1980 and 1990, assuming a 1% per year growth in waste generation, a worst case assumption. In 1973, industry data indicated that 4.8 pounds per person per day was being collected in the metropolitan portion of the County (Oakland). The charts are based upon 5.0 pounds per person per day in 1973, 5.1 pounds in 1975, 5.36 pounds in 1980, and 5.9 pounds in 1990. 1975 is used as the base year for developing Policies and the overall Plan; 1976 through 1980 will be the first five-year action program. Implementation of Plan Policies are planned to begin in 1976-1980.

Cities which have separate collection systems are shown separately throughout the charts. It would be reasonable to assume that in time all systems will operate based upon optimum transfer and processing stations location and that all collection systems will funnel into the processing facility(s). While it is assumed that optimizing will occur at transfer station, processing facility, and landfill, no immediate changes in present collection systems are postulated. However, collection systems should be examined thoroughly as soon as possible, to determine optimizing changes which should be made.

Each of the four Planning Units in Alameda County as shown on the map is considered a "disposal service area." In the charts, some cities are shown individually if the collection system is different from the rest of the disposal service area. Although intra-city operations are really individual cases (franchises, or municipal operations) the establishment of a planning unit-wide disposal service area addresses common problems on a sufficiently large geographic basis for planning waste management systems. Waste

generated in each Planning Unit will be channeled through as many optimally located transfer and processing stations as are necessary depending on the waste quantities and needs of the community. An attempt has been made to represent the collection-disposal conditions in each area or sub-area as it now exists and to incorporate reasonable changes over time. For example, within the Central Metropolitan Planning Unit (CMPU) the cities of Berkeley and Alameda have their own collection systems. Berkeley is a municipally operated system, and Alameda is a small private operation. The estimation and handling of waste from these two cities is shown separately from the others in the CMPU through 1990. Eventually these collection operations should be routed to the area-wide processing facility.

The Eden Planning Unit (EPU) in the past has been served by the West Winton Avenue disposal site. Garbage from the cities of San Leandro, Hayward, and the unincorporated areas of Castro Valley and San Lorenzo will be hauled to the Davis Street site for disposal. The portion of the city of San Leandro which is not in the Oro Loma Sanitary District is collected by Oakland Scavenger Company under a franchise agreement. This situation in San Leandro is not expected to change and presents some difficulty to represent clearly in the charts, so it all has been included under one heading--San Leandro.

The Washington Planning Unit (WPU) which includes the cities of Fremont, Newark, and Union City has two landfills. One landfill is used for municipal collection and disposal (Durham Road) and the other is open to the general public and industry. A clause in the Use Permit (City of Fremont U-64-30, U-66-35) prevents the disposal of waste from outside the WPU.

The Livermore-Amador Valley Planning Unit (LAVPU) includes the cities of Pleasanton and Livermore and the unincorporates areas of Sunol and Dublin. There are two landfills in this area: Pleasanton Public Dump which will close in late 1975 or early 1976 and the Eastern Alameda County site on Vasco Road. Collection is through Pleasanton Garbage Service and Oakland Scavenger Company (Livermore and Dublin).

Community Recycling and Source Reduction

The weighing made by Oakland Scavenger and used as a basis for estimating solid waste generation is actually a measure of solid waste arriving at the disposal site. In fact, a slightly greater amount of solid waste is generated and a small portion is delivered to community recycling center, thus not included in the 4.8 lbs/capita/day[1] figure.

[1]Based on Oakland Scavenger weighing, August, 1973.

Community recycling tonnage ranges from a maximum estimate of 2% of total solid wastes to a minimum of almost nothing; countywide recycling is certainly less than 1%. Because participation in recycling programs is limited and volume is small anyway, it is not shown in the flow charts. Increased environmental awareness may tend to increase community recycling activity as would mandatory source separation programs. But on the other hand, as systems for recovering materials from the waste stream come on line, there may be less cause for motivated individuals to carry on their recycling activity. For the purposes of this report, it is sufficient to recognize that recycling and source reduction exist and to assume that the current levels of activity will continue.

Alternative Systems - Oakland Scavenger

A system of transfer stations and material recovery facilities has been proposed by Oakland Scavenger. Wastes would be shredded in a large hammermill and subjected to elaborate material recovery equipment that would separate 10% of the total input, primarily metals and glass. The remaining 90% output would either be input to an energy recovery system or be long hauled to landfill disposal.

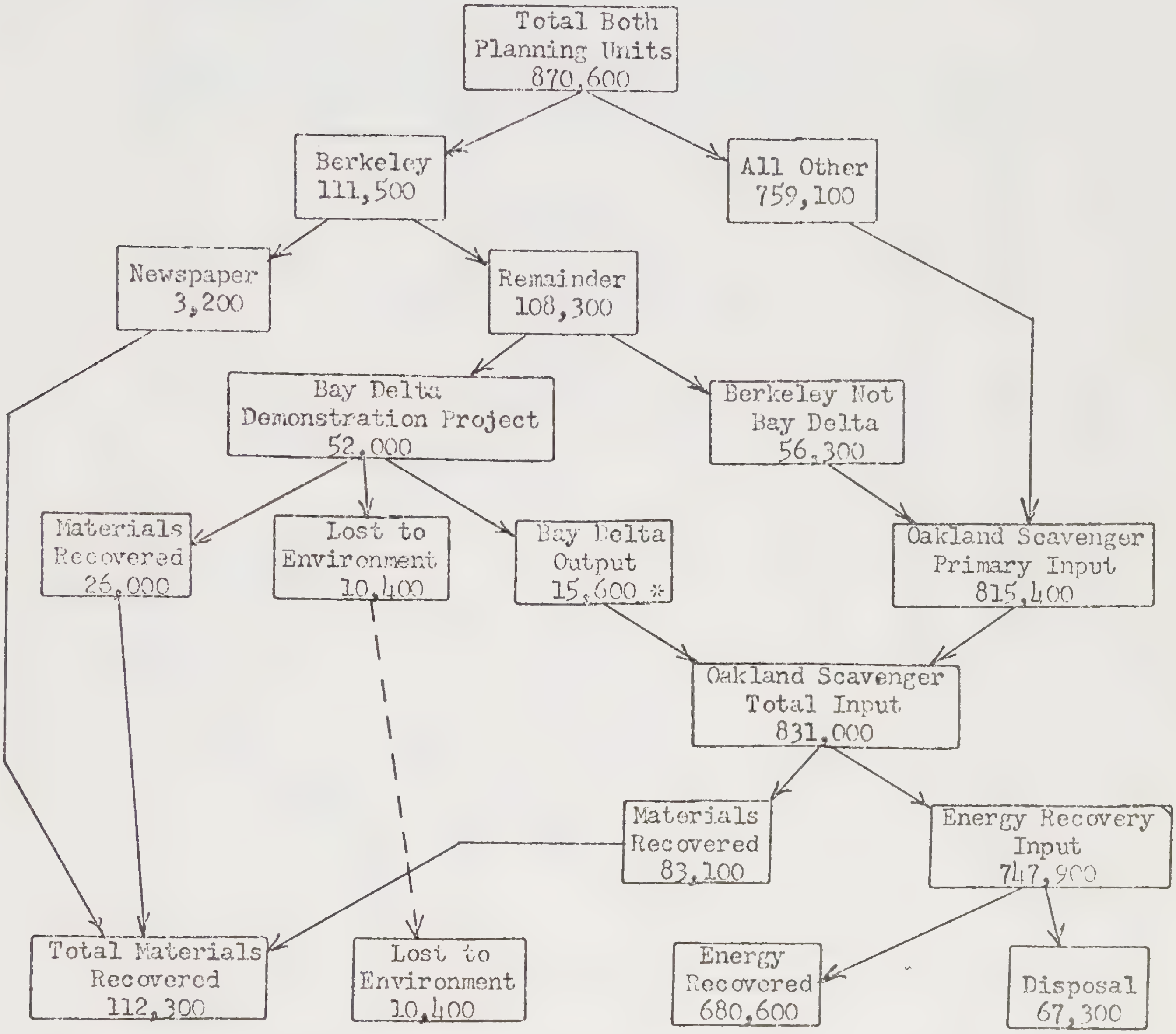
Alternative Systems - East Bay Municipal Utility District/Pacific Gas and Electric

An energy recovery system developed by Union Carbide and sponsored by East Bay Municipal Utility District and Pacific Gas and Electric is being studied for its feasibility to handle processed solid wastes and sewage sludge from the Central Metropolitan and Eden Planning Units. The system called Purox takes in directly the output of a materials recovery system (such as Oakland Scavenger's), reduces its weight by about 91 percent, and produces oil and gas suitable for many heating applications. The remaining 9 percent output would probably be disposed.

Included among the possibilities of combined systems in the medium term future is a Bay Delta demonstration-size project (Berkeley), discussed below, and the Oakland Scavenger-East Bay Municipal Utility District systems. The Bay Delta demonstration project would be 200 tons per day or 52,000 tons per year. That portion of Berkeley's generation not going into the Bay Delta project as well as the output of the Bay Delta would be delivered to Oakland Scavenger's Davis Street processing facility for further handling. The Bay Delta output fraction would have had some of its material and energy recovery potential already removed. A graphic presentation of the interrelationship of these three systems working together is shown in Figure V-10.

Figure V-10

FLOW CHART OF SOLID WASTE FROM CMPU AND EPU THROUGH BAY DELTA DEMONSTRATION PROJECT, OAKLAND SCAVENGER COMPANY AND EBMUD/PG&E SYSTEMS: TONS/YEAR, 1980[1]

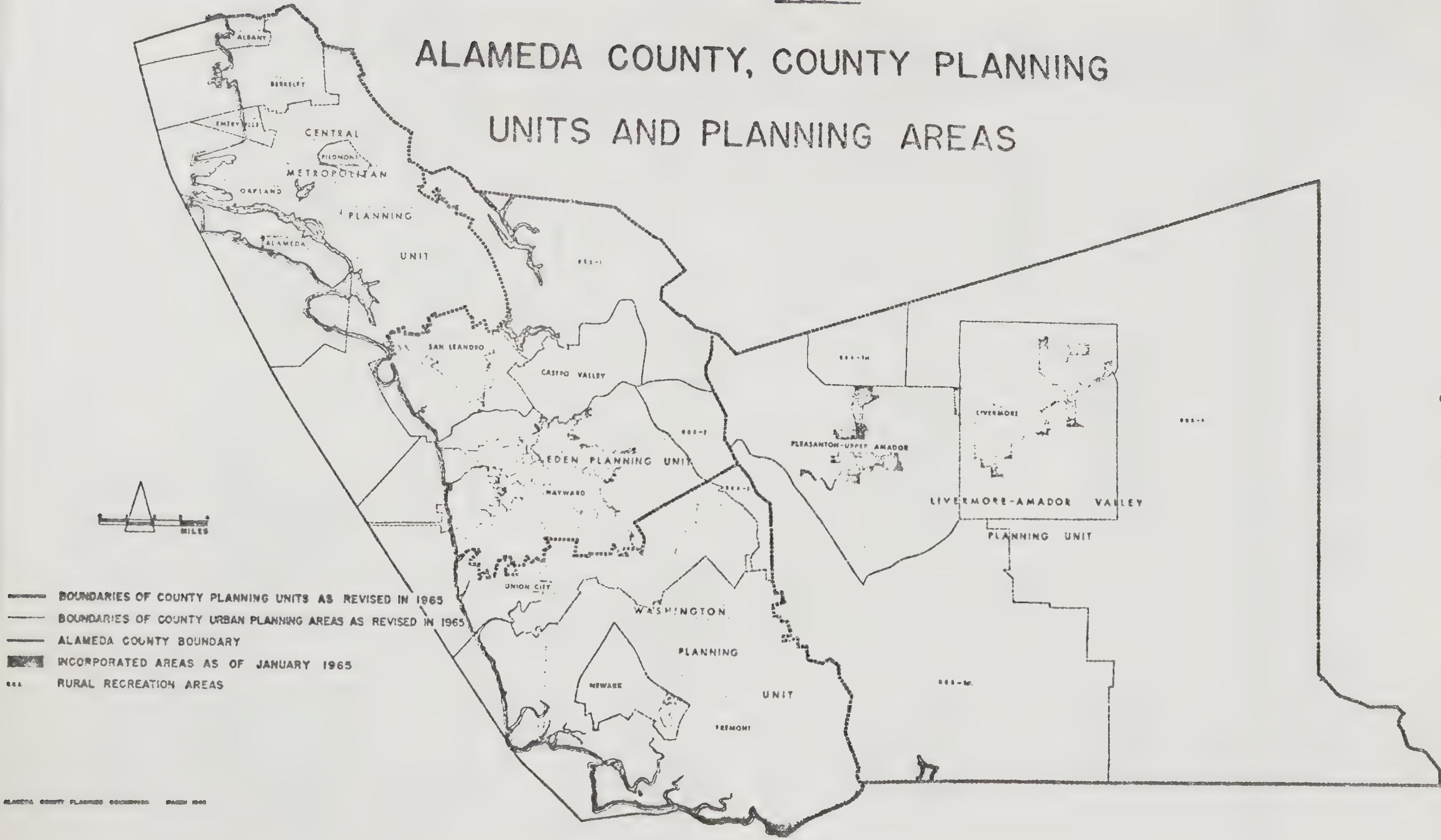


* This fraction has limited characteristics.

[1] Estimated by Alameda County Planning Department, October, 1974.

Map V-1

ALAMEDA COUNTY, COUNTY PLANNING UNITS AND PLANNING AREAS



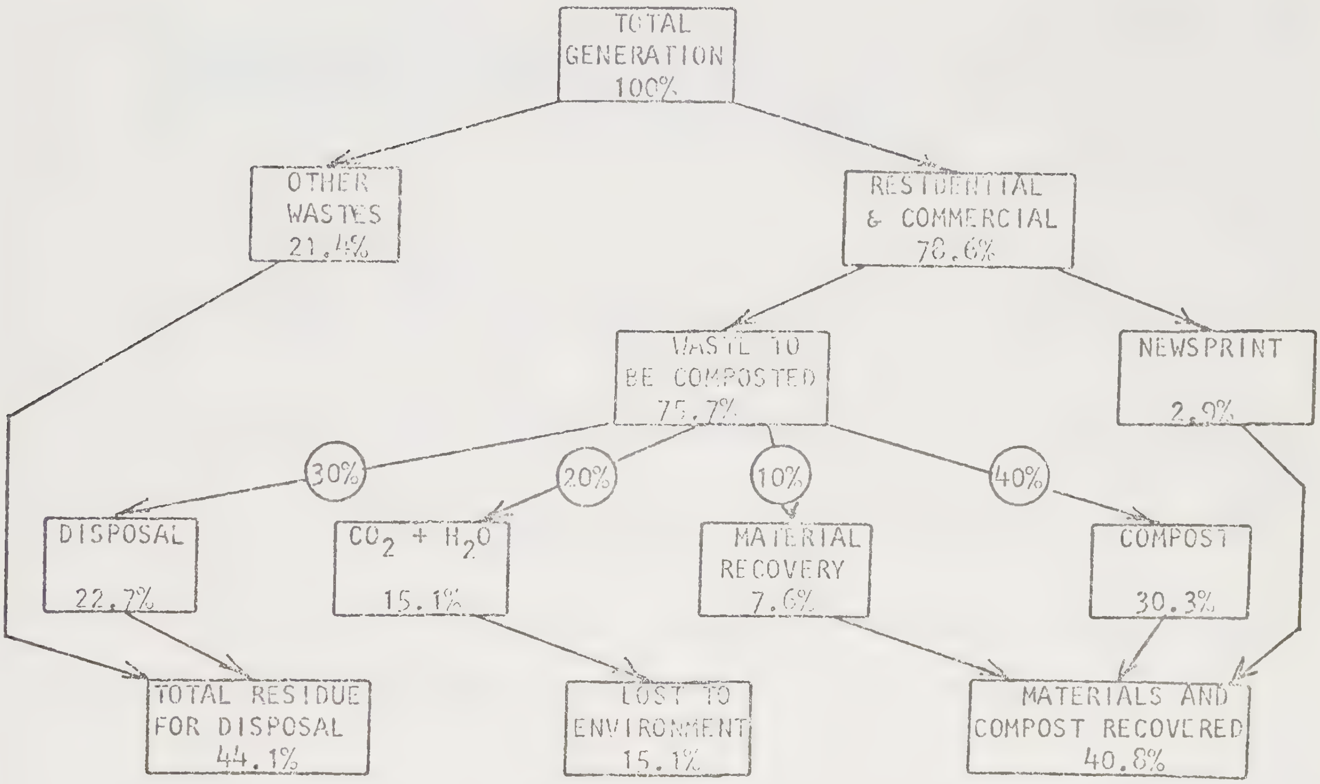
Alternative Systems - Bay Delta

The Bay Delta composting system would only accept residential and commercial refuse. The remaining demolition and industrial wastes would be disposed conventionally. It is proposed that half of Berkeley's newspaper be source separated. The existing community recycling program is now recovering an estimated 17% of this goal; the remaining 83% would be collected on the packer trucks.

The disposition of the wastes stream through composting is as follows: 40% compost, 10% materials recovery, 20% carbon dioxide and water lost to the environment, and 30% disposal residue. Figure V-11 shows the flow of wastes through the Bay Delta system:

Figure V-11

PERCENTAGE FLOW OF TOTAL SOLID WASTE THROUGH BAY DELTA SYSTEM



SOURCE: Compiled from information given in Bay Delta Project Report, Volume I, pages 52, 56, & 57 by Alameda County Planning Department.

The 44.1% shown as total residue for disposal would be landfilled in the absence of any other processing system and would be handled through the Oakland Scavenger Davis Street processing facility in the event that system is operating.

Finally, the flow charts are presented which depict the most likely and feasible systems and combinations of systems for handling the solid wastes generated in Alameda County in succeeding planning periods. As a reference, the 1973 existing system is first shown on the same format. Evaluation of these alternatives together with economic information which is forthcoming should provide committee members with a basis for making optimal recommendations.

Estimating Waste Generation

The method of estimating the tonnage of solid wastes generated by these seven areas is multiplying the population by a generation factor. This estimation method accounts for both trends in the population and increases in per-capita generation.

Population

The population figures used come from several sources and are considered to be the most current available. Table V-1 presents the population figures used for this report.

Table V-1

ESTIMATED POPULATION FOR SELECTED CITIES, PLACES, AND PLANNING UNITS IN ALAMEDA COUNTY: 1973, 1975, 1980, and 1990

Area	1973	1975	1980	1990	2000
CMPU	581,800	585,000	594,000	601,000	601,000
Berkeley	114,000	114,000	114,000	114,000	NA[4]
Alameda	76,100	79,500	85,000	90,500	NA
Remainder CMPU	391,700	391,500	595,000	396,500	NA
EPU	283,500	285,000	296,000	312,000	329,000
LAVPU [2]	100,100	104,000	121,100	158,200	206,400
Pleasanton P.A.	31,400	32,600	38,000	49,700	NA
Remainder LAVPU	68,700	71,400	83,100	108,500	NA
(San Ramon Portion)	(995)	(1,019)	(1,082)	(1,218)	(1,372)
WPU	182,000	190,000	206,000	267,000	346,000
COUNTY TOTAL[3]	1,147,400	1,164,000	1,217,100	1,338,200	1,482,400

[1]Population figures presented in Table VI-1 for 1973 are preliminary estimates prepared by Alameda County Planning Department, April, 1973. Figures for the Planning Units in 1975, 1980, 1990, and 2000 are "B" series projections by Alameda County Planning Department, October 7, 1964, with one exception of the Washington Planning Unit in 1975 where the "A" series projection is used to avoid an apparent contradiction. The populations given for the Livermore-Amador Valley Planning Unit include the projected population in the portion of San Ramon. The figures for Berkeley and Alameda were made in April, 1974, by Cal Trans and Alameda County Planning Department in connection with the Corridor Study. Using 1973 as a base year, the population of the Pleasanton Planning Area is assumed to be the same proportion of the Livermore-Amador Valley Planning Unit in 1975, 1980, and 1990 that it was in 1973.

[2]Based on collection data supplied by Dublin Disposal Service (Oakland Scavenger Company), 995 population in San Ramon received service in 1973. It is assumed that this portion of San Ramon will continue and that the population will increase by 1.2 percent per year, the Alameda County average growth. Thus, the populations 1,015 in 1980, and 1,218 in 1990, are computed by Alameda County Planning Department based on 995 in 1973.

[3]Note that a portion of San Ramon, Contra Costa County, is included in these figures.

[4]Projections to 2000 not available for the cities or planning areas.

Generation Factor

In August 1973, Oakland Scavenger conducted a weighing of municipal solid wastes delivered to their Davis Street site. This resulted in a 4.8 pounds per capita per day generation factor for this portion of Alameda County. This factor is increased to 5.00 lbs./capita/day for base year planning purposes, and estimated for 1975, 1980, and 1990, by assuming a 1% per year growth rate. Previous weighing studies have shown that the increase in solid waste generation in recent years has been about 1% per year. Table V-2 gives the estimated generation factors used in this report:

Table V-2

ESTIMATED SOLID WASTE GENERATION FACTORS FOR ALAMEDA COUNTY: 1973, 1975, 1980 AND 1990

Year:	1973	1975	1980	1990
lbs/capita/day:	5.00	5.10	5.36	5.92

It should be noted that the weighing study was made at the Davis Street site which serves the central metropolitan area. Solid waste generation in less dense urban and in rural areas may be 10% less than in the metropolitan area. Certain materials, such as solid inert materials, i.e. earth, paving and concrete rubble, etc., are not included in the factors; these materials do not usually enter the solid waste stream.

Solid Waste Generation

From the above factors and population data the estimates of solid waste generation in selected geographic areas of Alameda County are presented in Table V-3. This data is given in tons per year.

Data for the year 2000 will be developed during the plan periodic review process, when population projections for the cities becomes available.

Table V-3

ESTIMATED SOLID WASTE GENERATED FOR COLLECTION IN SELECTED CITIES, PLACES, AND PLANNING UNITS OF ALAMEDA COUNTY: 1973, 1975, 1980, & 1990 (tons/year)

Area	1973	1975	1980	1990
CMPU	530,900	544,500	581,100	649,300
Berkeley	104,000	106,100	111,500	123,200
Alameda	69,400	74,000	83,100	97,800
Remainder CMPU	357,400	364,400	386,500	428,400
EPU	258,700	265,300	289,500	337,100
LAVPU[1]	91,300	96,800	118,500	170,900
Pleasanton P.A.	28,700	30,300	37,200	53,700
Remainder	62,700	66,500	81,300	117,200
WPU	166,100	176,800	201,500	288,500
COUNTY TOTAL[2]	1,047,000	1,083,400	1,190,600	1,445,800

[1] Based on collection data supplied by Dublin Disposal Service (Oakland Scavenger Company), 995 population in San Ramon received service in 1973. It is assumed that this portion of San Ramon will continue and that the population will increase by 1.2% per year, the Alameda County average growth. Thus, the populations 1,015 in 1980, and 1,218 in 1990 are computed by Alameda County Planning Department based on 995 in 1973.

[2] Note that a portion of San Ramon, Contra Costa County, is included in these figures.

Figure V-12

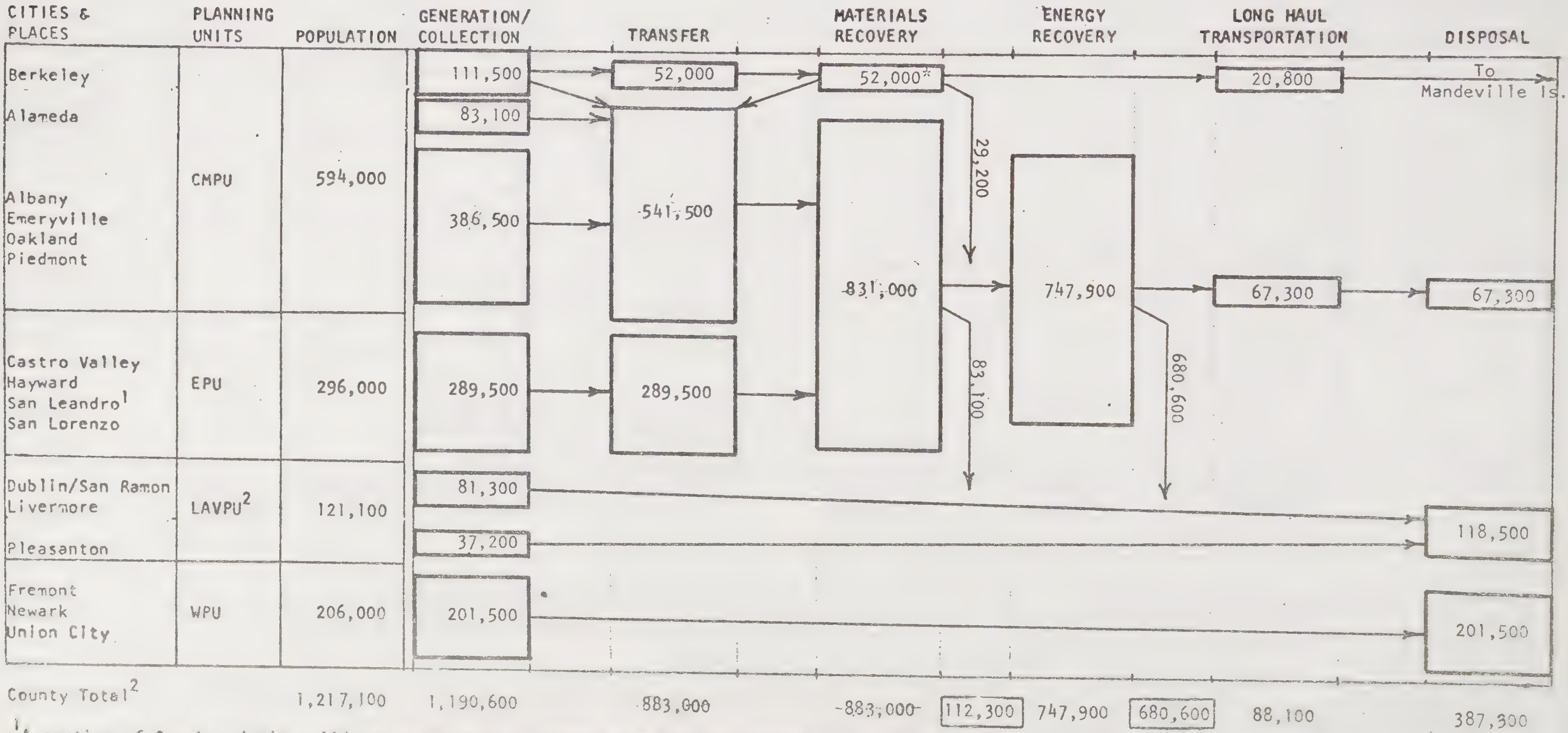
1975 Solid Waste Management System (tons per year)
None of the known proposals could be on line at this time; some landfills will have reached capacity & closed.

CITIES & PLACES	PLANNING UNITS	POPULATION	GENERATION/ COLLECTION	TRANSFER	MATERIALS RECOVERY	ENERGY RECOVERY	LONG HAUL TRANSPORTATION	DISPOSAL
Berkeley	CMPU	585,000	106,100					106,100
Alameda			74,000					703,600
Albany Emeryville Oakland Piedmont			364,400					
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	285,000	265,300					
Dublin/San Ramon Livermore	LAVPU[2]	104,000	66,500					96,800
Pleasanton			30,300					
Fremont Newark Union City	WPU	190,000	176,800					176,800
County Total[2]		1,164,000	1,083,400					1,083,400

[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure V-13

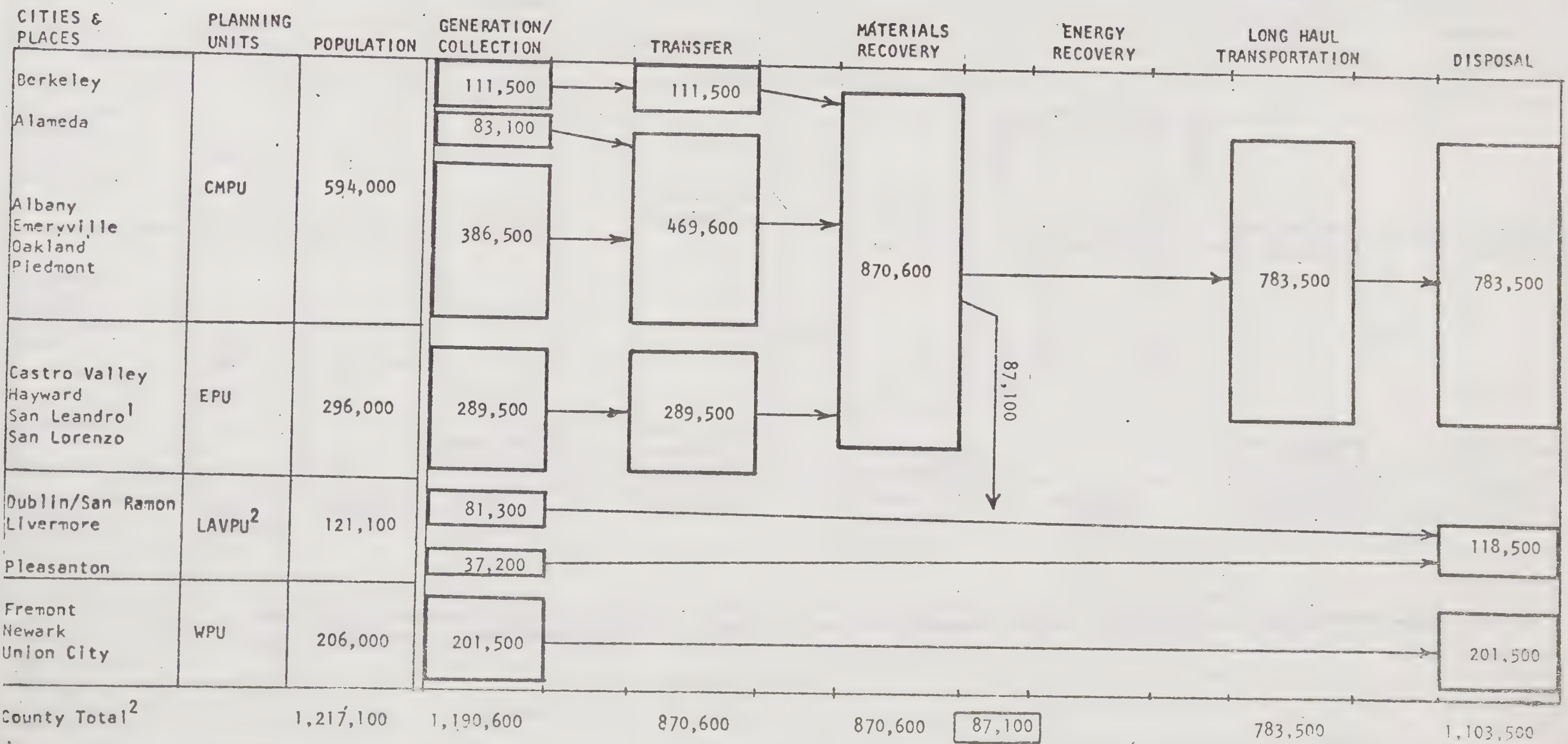
1980 Solid Waste Management System (tons per year) Alternate 1980-A $\boxed{792,900}$ Resource Recovery=67%
Bay Delta Demonstration, Oakland Scavenger & E.B.M.U.D./P.G.&E. proposals on line.



1 A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
2 A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.
*10,400 lost to environment

Figure V-14

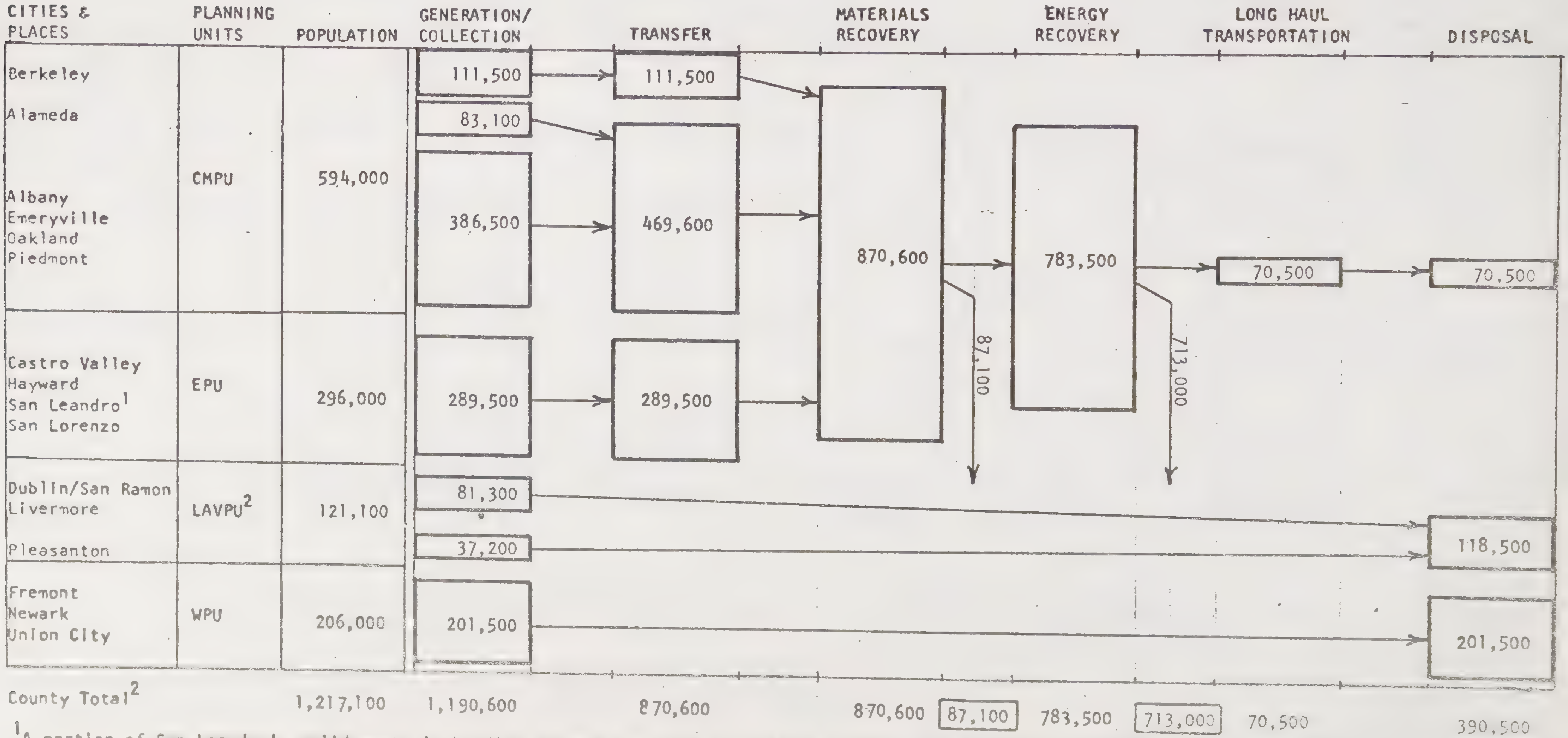
1980 Solid Waste Management System (tons per year) Alternative 1980 - B $\boxed{87{,}100}$ Resource Recovery = 7%
Oakland Scavenger proposal on line.



[1]A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2]A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure V-15

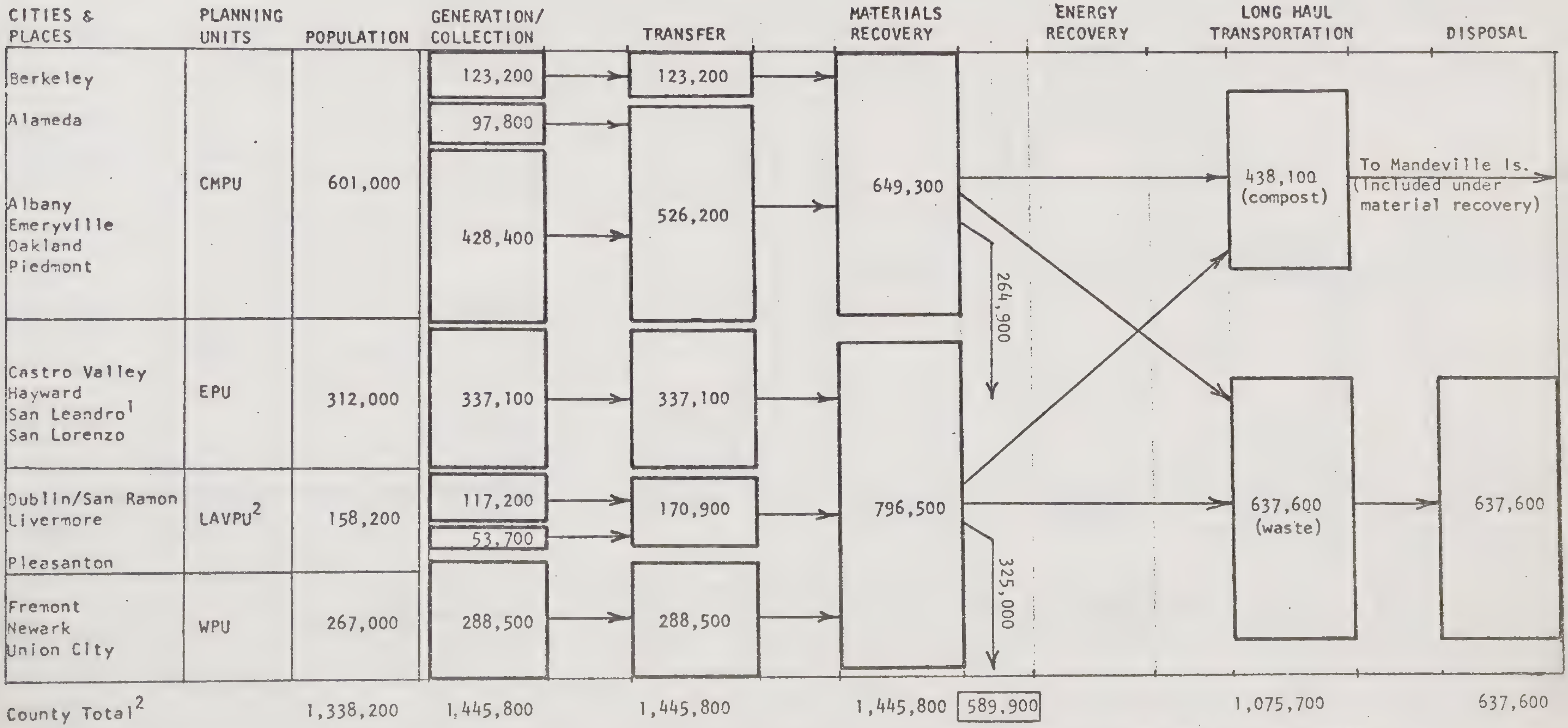
1980 Solid Waste Management System (tons per year) Alternative 1980 - C $\boxed{800,100}$ Resource Recovery = 67%
Oakland Scavenger & E.B.M.U.D./P.G.&E. proposals on line.



[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure V-16

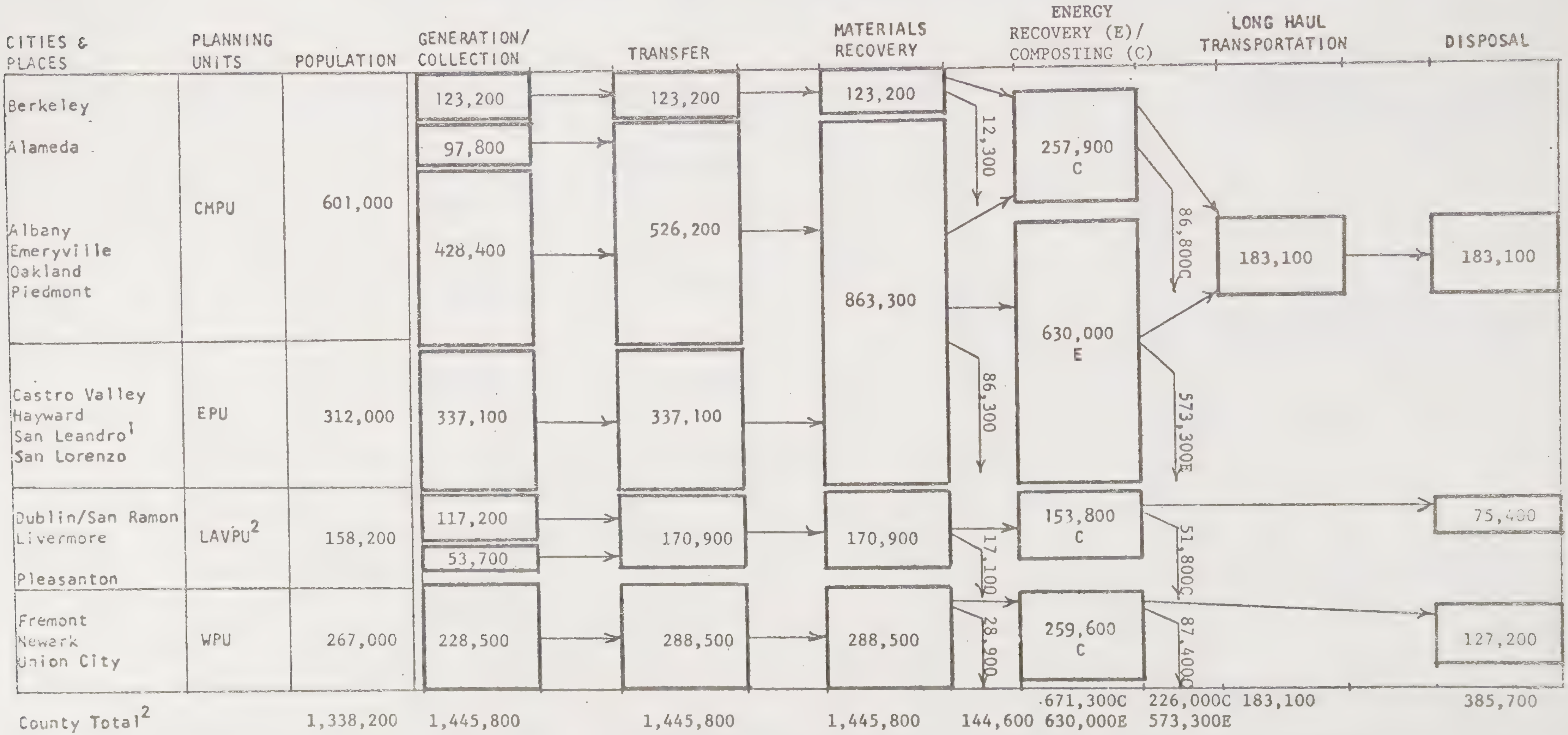
1990 Solid Waste Management System (tons per year) Alternative 1990 - A $\boxed{589,900}$ Resource Recovery = 41 %
Full Scale Bay-Delta System



[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure V-16a

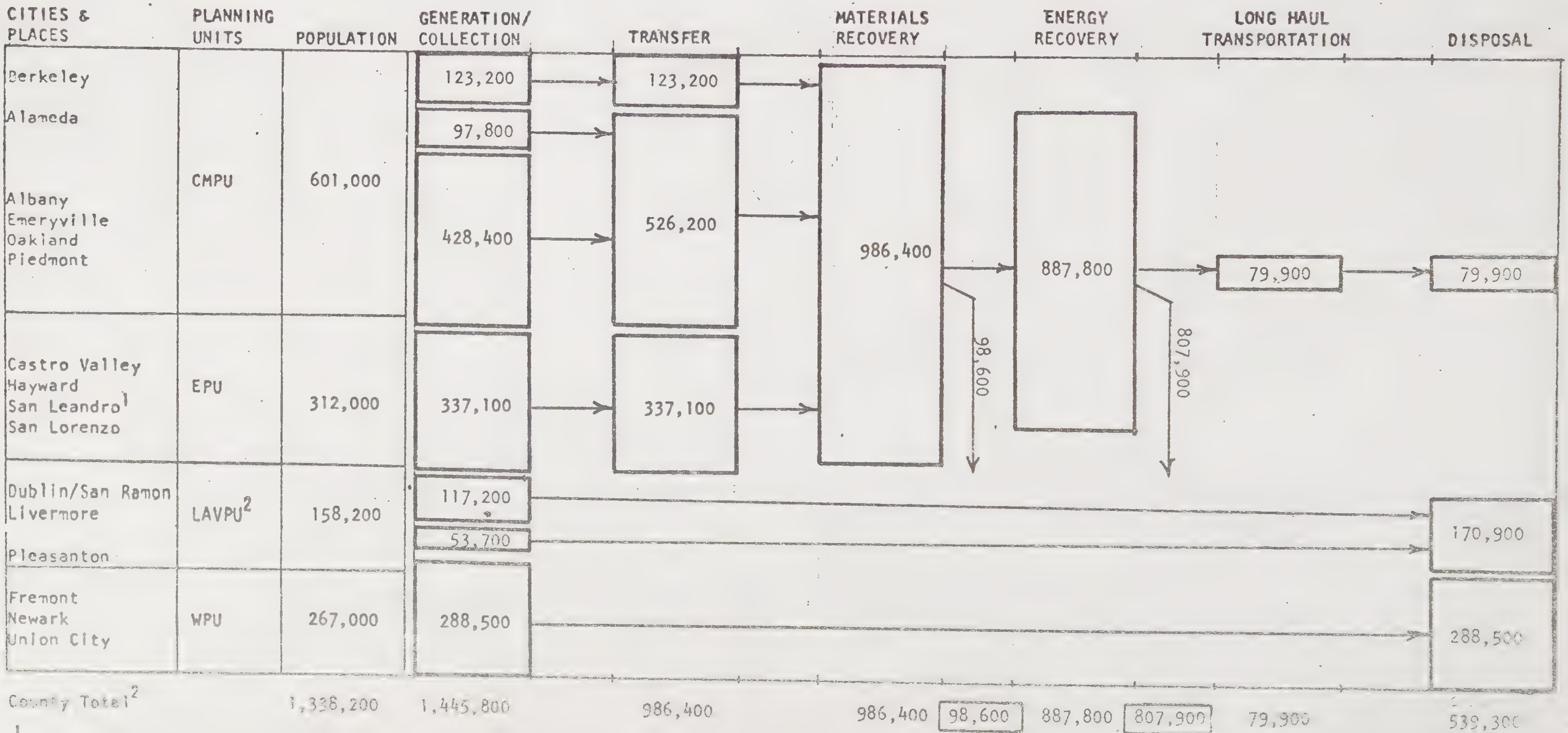
1990 Solid Waste Management Alternative 1990 - A2 (tons per year)
1750 TPD Energy Recovery Plant and Local Composting Plants (600 T/D±) Resource Recovery = 943,900 = 65%



[1]A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2]A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure V-17

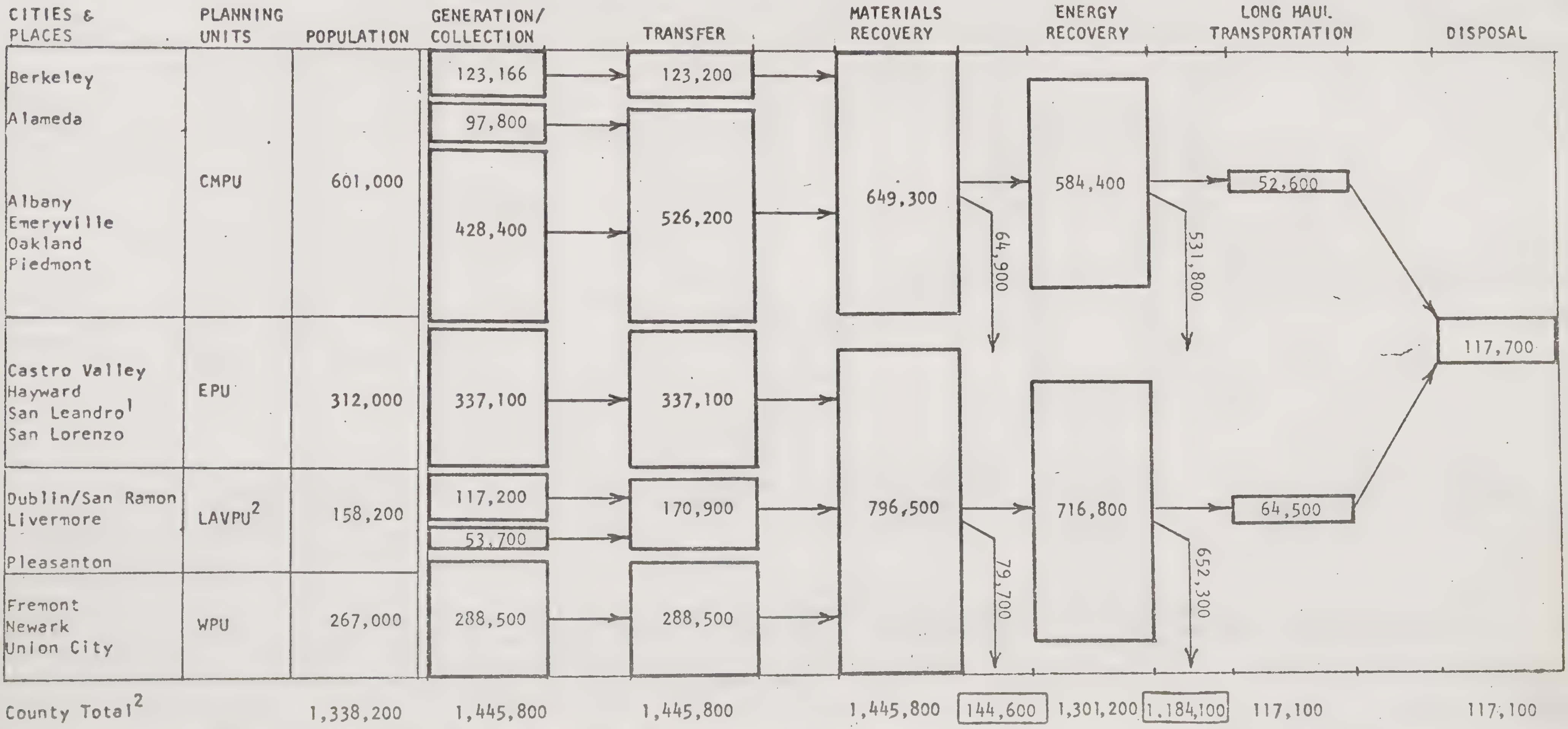
1990 Solid Waste Management System (tons per year) Alternative 1990 - B $\boxed{906,500}$ Resource Recovery = 63%
Oakland Scavenger & E.B.M.U.D./P.G.&E. proposals on line except for LAVPU and WPU.



[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure V-18

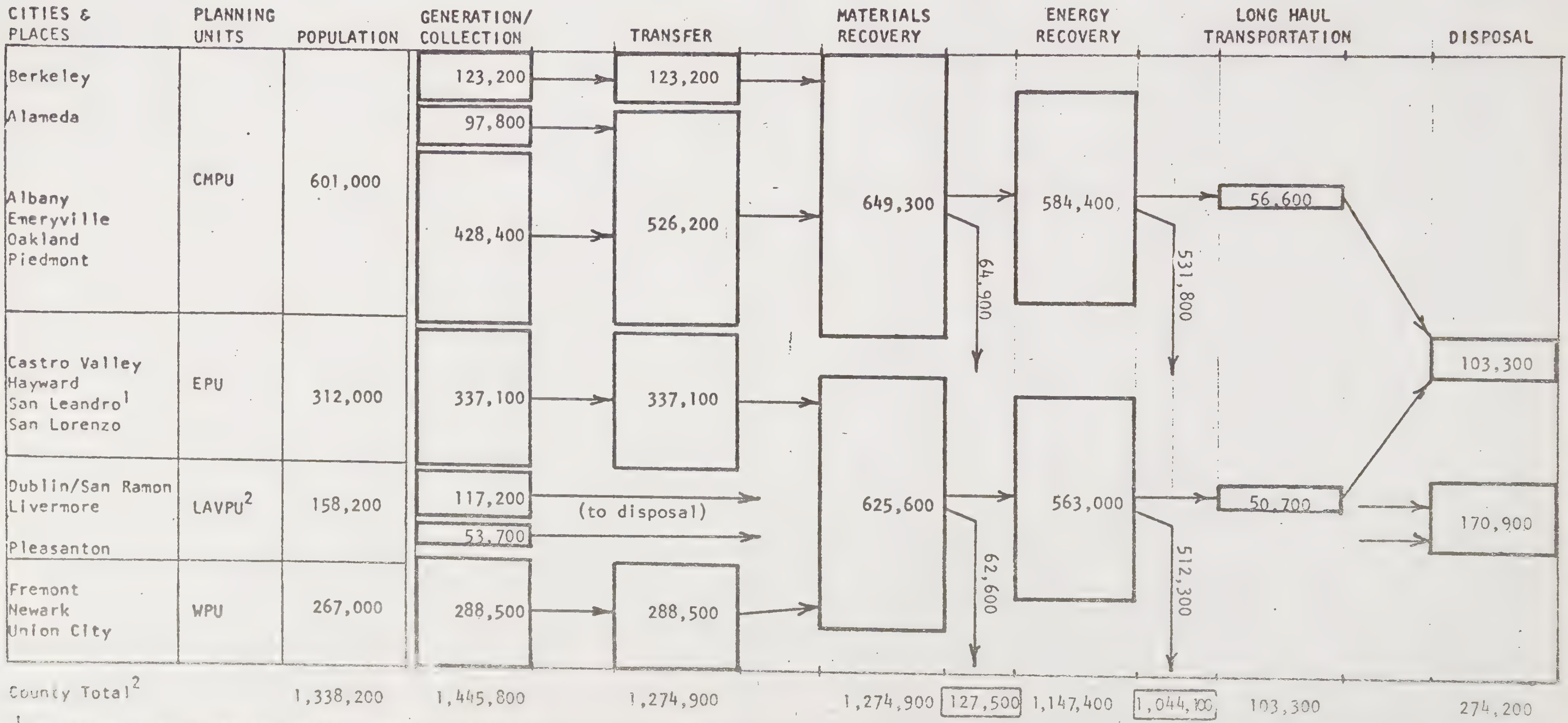
1990 Solid Waste Management System (tons per year) Alternative 1990 - C $\boxed{1,328,700}$ Resource Recovery = 92%
Full scale Oakland Scavenger & E.B.M.U.D./P.G.&E. proposals on line.



[1]A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2]A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure V-19

1990 Solid Waste Management System (tons per year) Alternative 1990 - D 1,171,600 Resource Recovery = 81 %
Oakland Scavenger and E.B.M.U.D./P.G.&E. proposals on line except for LAVPU.



[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

2. System Outputs:

Municipal solid waste is composed of paper, metals, glass and other organic matter. In terms of recovery and marketing of these materials, each is a unique case because of differences in existing demand or supply, value, existing processing plants, and material contamination among other reasons. Each material requires independent analysis to determine the best way to effect its recovery.

The composition of municipal solid wastes varies slightly, depending upon its origin, but this variation is not significant to the purpose of this report. Research undertaken by the National Center for Resource Recovery has resulted in estimates of municipal solid waste composition by weight. Although several studies have developed similar breakdowns, the following data in Table V-4, prepared for Contra Costa County, seems to be the most reasonable and useful with respect to the other studies done on composition.

Approximate Composition of Municipal Solid Waste

Table V-4

Material		Percent by Weight
Paper and Paperboard		
Corrugated	22	
Newspaper	9	
Other	12	
Total		43
Ferrous Metal		
Cans	5	
Other	3	
Total		8
Aluminum and Other Non-Ferrous Metal		1
Glass and Ceramics		10
Garbage and Yard Waste		33
Miscellaneous:		
Plastics, textiles, rubber, etc.		5
Total		100

Sources:

National Center for Resource Recovery, Bulletin, Vol. III, No. 2, Spring, 1973.

"Cleaning Our Environment", report by the American Chemical Society, 1969, p. 165.

"Solid Waste Management; a Comprehensive Assessment of Solid Waste Problems, Practices and Needs", Office of Science and Technology, 1969, U.S.

"Comprehensive Studies of Solid Waste Management", First and Second Annual Reports, Sanitary Engineering Research Lab, Univ. of Calif., 1970, U.S. Public Health Service Report SW 3rg.

SOURCE: The Citizens Advisory Committee on Solid Waste Recycling: Final Report & Recommendations, January 1974, Central Contra Costa Sanitary District, page 18.

Table V-4 applies to municipal solid waste only. Municipal solid waste comprises about one-half of the total. The remainder, mostly industrial and some agricultural solid waste, is not rich in valuable recoverable materials and, consequently, is not being considered as a source of secondary materials.

Using the NCRR composition estimates and generation tonnage figures developed for Alameda County in Part VI of the Plan, estimated generation by material is computed below in Table V-5. Multiplying by the current unit value, $300/ton for nonferrous and $20/tons for all others, shows the approximate value of these resources that are now being deposited in landfills. Tonnage and value that is presently recycled by community recycling centers is not included in this data.

Table V-5

ESTIMATED GENERATION OF SOLID WASTE BY RECOVERABLE MATERIAL AND GROSS VALUE IN MUNICIPAL FRACTION[1]: ALAMEDA COUNTY AND FOUR CONSTITUENT PLANNING UNITS, 1975

Planning Unit	Total Generation (Tons/Yr.)	Ferrous Metals (8%)		Nonferrous Metals (1%)		Glass (10%)		Newspaper (9%)		Corrugated Cardboard (22%)		Total Recoverable (50%)	
		Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million
CMPU	544,500	21,800	$0.44	2,720	$0.82	27,200	$0.54	24,500	$0.49	59,900	$1.20	136,100	$3.49
EPU	265,300	10,600	$0.21	1,330	$0.40	13,300	$0.27	11,900	$0.24	29,200	$0.58	66,300	$1.70
LAVPU[2]	96,800	3,900	$0.08	480	$0.14	4,800	$0.10	4,400	$0.09	10,600	$0.21	24,200	$0.62
WPU	176,800	7,100	$0.14	880	$0.26	8,800	$0.18	8,000	$0.16	19,400	$0.39	44,200	$1.13
COUNTY	1,083,400	43,300	$0.87	5,420	$1.63	54,200	$1.08	48,800	$0.98	119,200	$2.38	270,900	$6.94

[1]Municipal fraction is assumed to be half of the total generation.

[2]A portion of San Ramon, Contra Costa County, in included in the LAVPU data.

Scanning Table V-5, it becomes apparent that an immense amount of potentially recoverable materials or resources are not being utilized Corrugated cardboard, a material which is itself largely made from recycled fiber, represents an annual loss of over $2.3 million. Nonferrous metals lost to landfill are of high value per tons and amount to over $1.6 million annually in spite of their small volume (about 1%). Recently, in a nationally broadcast speech, President Ford emphasized the immense value of resources thrown away by Americans and the positive impact upon the inflation problem that recovering those resources would have. Total recoverable resources lost in Alameda County along are estimated to be $6.9 million annually.

While Table V-5 shows the resources lost through the existing solid waste stream, technological limitations prevent the full recovery of these materials. For example, existing methods of separating aluminum from municipal solid waste will only capture 70% of the metal going through the separation system. Table V-6 presents the results of study done by the National Center for Resource Recovery on technologically feasible recovery rates.

Table V-6

Input, Recovery Rates and Output of Municipal Solid Waste Separation Equipment.[1]

Material	Input		Recovery Rate	Marketable Output	
Paper	43%		10.0%	4.3%	
Ferrous	8%		94.5%	7.6%	
Glass	10%		64.0%	6.4%	
Aluminum	0.7%)	) 1%	70.0%	0.5%)	) 0.7%
Other Nonferrous	0.3%)		80.0%	0.2%)	
Total				19.0%	

[1]Materials Recovery System, NCRR, Table 3-1, page 3-21

Note the relative recovery rates of each material, particularly paper, because this technological limitation has strong implications as to the optimum resource recovery scheme; this point will be developed later in this report, when paper is discussed individually.

Again, applying the recovery percentages to the planning unit generation figures, an estimate is made of the tonnage and value of the resource materials that could actually be recovered for marketing.

Table V-7

ESTIMATED RECOVERY AND NET VALUE OF MATERIALS SEPARABLE FROM SOLID WASTES UNDER CURRENT TECHNOLOGY: ALAMEDA COUNTY, 1975

Planning Unit	Total Generation (Tons/Yr.)	Ferrous Metals (7.6%)		Nonferrous Metals (0.7%)		Glass (6.4%)		Newspaper (0.9%)		Corrugated Cardboard (2.2%)		Total Recoverable (17.8%)	
		Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million	Amount (Tons/Yr.)	Value $ Million
CMPU	544,500	20,700	$0.21	1,910	$0.57	17,400	$0.14	2,450	$0.02	5,990	$0.06	48,500	$1.00
EPU	265,300	10,100	$0.10	930	$0.28	8,500	$0.07	1,190	$0.01	2,920	$0.03	23,600	$0.49
LAVPU[1]	96,800	3,700	$0.04	340	$0.10	3,100	$0.02	440	$0.00	1,060	$0.01	8,600	$0.17
WPU	176,800	6,700	$0.07	620	$0.19	5,700	$0.04	800	$0.01	1,940	$0.02	15,700	$0.33
COUNTY	1,083,400	41,200	$0.41	3,790	$1.14	34,700	$0.27	4,880	$0.05	11,920	$0.12	96,400	$1.99

[1]A portion of San Ramon, Contra Costa County, is included in the LAVPU data.

Significantly lower estimated unit values are used in Table V-7 because of less pure output and possibly depressed prices due to over supply. The estimated unit values used are those developed by NCRR: Ferrous metals @ $10/ton, nonferrous metals @ $300/ton, 5/8 of the glass @ $12/ton, 3/8 of the glass @ $1/ton and paper and corrugated @ $10/ton. The 5/8 portion of the glass is of larger size and color sorted, and the remaining 3/8 is undifferentiated fines.

Recovered Energy

The most recent estimate of the energy which can be recovered from solid wastes was made by the Ralph M. Parsons Company in the report[1] evaluating the Union Carbide Purox system. Even though this study of the Purox system was a study of a specific proposal, the results may be generalized to give data useful at a planning scale.

Four alternative output products have been presented as possible sources of energy: 1) syngas; the direct output of the Purox process, 2) methane; a pipeline quality gas, 3) electric power, 4) methanol; a common industrial chemical and fuel. Following are the unit ouputs of energy based on the findings of the Parsons study[2]:

	Type of Output			
Output/Ton Input	Syngas	Methane	Electric Power	Methanol
Standard Cubic Feet Gas	24,000	5,400	-	-
Kilowatts Electricity	-	-	625	-
Gallons Methanol	-	-	-	67
Energy (10^6 BTU's)	6.20	4.16	1.78	3.60

[1] Eberrs Report, Ralph M. Parsons Company, March 1975.
[2] Ibid, page 2-5.

Taking an example of an energy output computation, assume that the energy recovery unit for the CMPU in the Alternative 1990-D will produce methane. The Parson's study indicates that the expected output of methane gas would be 4.16 million BTU's per ton of refuse input. Multiplying the CMPU refuse input to energy recovery, 584,400 tons per year, times the energy produced per ton, 4.16 million BTU's, roughly equals the expected energy recovery per year:

$$584,400 \text{ tons/year} \times 4.16\ 10^6 \text{ BTU's/ton} = 2,431,000\ 10^6 \text{ BTU's/year}$$

Similarly, the energy recovered in Alternative 1990-D for the total county would be approximately 4,733,000 million BTU's per year. This amount of energy is enough to heat over 80% of all the housing units in the city of Oakland. Stated in another way, this amount of energy produced from solid waste is sufficient to meet the gasoline needs of about 34,600 average motorists, which would represent a city slightly larger than Alameda.

Residues

The last column in the flow charts shows the tonnage of solid waste to be disposed or otherwise utilized. The possible system ouputs for disposal are unprocessed solid waste, compost and incinerator ash or slag.

Unprocessed solid waste is valueless and must be transported and disposed of safely in a sanitary landfill. Unprocessed waste can produce leachate and cause serious contamination of groundwater as well as become unsightly if not properly handled. The relatively low density of the solid waste material makes it more troublesome and expensive to deal with.

In contrast to unprocessed solid waste, both compost and incinerator residue are more homogeneous and dense and are more easily handled. Compose and incinerator slag will usually have a value. Compose is useful as a soil amendment to improve the agricultural performance of land and as an engineering fill material. Incinerator residues can also be used as fill material as well as concrete aggregate and mix additives.

G. SUMMARY AND CONCLUSIONS

As disposal sites around the country approach capacity and as knowledge and awareness of the environmental and resource issues continue to build, a combined effort has been mounted to find solutions to these problems. Organizations from the refuse industry, the goods producing and recycling industries, the mining industry, government, academic institutions, and interested private groups hava all been researching the problem of solid waste management. As a result of this work, a number of systems have been built at a demonstration size and are now ready for full scale implementation.

One of the first changes in solid waste handling brought about by the closing of local disposal sites is the use of transfer stations and long haul to disposal. The break-even point is reached where it becomes less expensive to build a facility and transfer the locally collected refuse to highway trucks or rail cars for disposal at a distant landfill than to drive the collection trucks all the way and not build the transfer facility.

A more costly and complex solution which reduces the amount of solid waste to be disposed and simultaneously recovers valuable materials and resources is the construction of a resource recovery facility. The first part of resource recovery equipment which separates materials from the solid waste is called the front end system. Machinery which has been developed, based on experience gained from the mining industry, separates the metals, glass, and fibrous material from the remainder of the solid waste. In the course of extracting the valuable materials, the solid waste is prepared for either highly compacted shipment to landfill or input to an energy recovery system. Shredded waste is more compactible and more homogenous than non-shredded solid waste.

Recovering energy from solid waste not only provides an additional energy source, thus preserving existing sources, but provides a great reduction in the volume of solid waste. Refuse incineration to reduce the volume of solid waste has been practiced for years. Recently, as smog control measures have required cleaner exhaust gases, new types of refuse incinerators to meet air quality regulations have been developed. Other systems convert refuse into: 1) fuel gas or oil; 2) process shredded refuse into a pellitized fuel; or 3) feed it into a utility boiler as a supplement to fossil fuel.

It is sometimes thought that an energy recovery plant would provide a net income from its operation. On the contrary, even after selling the recovered heat or fuel, the plant will still have a net operating cost per ton, although the cost is reduced. The benefit of the energy recovery lies in its advantages over the alternative of landfill.

Regardless of the system, some amount of disposal will be required. It is universally agreed that the sanitary landfill is the only safe means of final refuse disposal. At the disposal stage, health and environmental protection should be major considerations. What is needed is a system that reduces dependency upon land disposal and recovers useful materials.

The alternative solid waste management systems for Alameda County covered herein attempt to demonstrate the integration of resource and energy recovery and include the components of: generation/collection; transfer; materials recovery; energy recovery; long haul transportation; and disposal. The systems presented in the alternative flow charts for 1980 and 1990 appear at this time to be both technically and financially feasible. When combined with the data on estimated capital and operating costs for each alternative, the various systems can be weighed and ranked as to their suitability for Alameda County.

The alternative systems proposed are: 1) a transfer and material recovery system; 2) an energy recovery system, presently being studied by East Bay Municipal Utility District and Pacific Gas and Electric; and 3) a compost and material recovery system, known as the Bay Delta project. One possible alternative is the combining of these systems, each processing the refuse of a particular geographic area or only handling a certain portion of the total processing.

Fortunately, there are several alternatives proposed herein for the short- and medium-term future. It is clear that some type of energy recovery system will have to be implemented if the State Solid Waste Management Board's goal of 25 percent reduction in landfill by 1980 is to be attained; material recovery and long-haul to disposal sites along, as indicated in this report, will only reduce the present solid waste landfill system by 15-20 percent. While the Bay Delta system would have a higher recovery percentage than the Oakland Scavenger system along, a still higher percentage would be attained if Berkeley's wastes were to be processed by an energy recovery system. The County is divided into four planning units. This report proposes new systems for Central Metropolitan and Eden Planning Units. However, no changes are shown for the Livermore-Amador and Washington Planning Units in the short-term (1980) future because adequate landfill capacity will exist through this time period.

In the long-term future, by the year 2000, it is likely that all of the planning units will participate in resource recovery systems. Alternatives for the long term are to be developed during periodic review of this Solid Waste Management Plan.

VI. ECONOMIC ANALYSIS AND FEASIBILITY - TECHNOLOGY

A. Systems Feasibility Criteria & Cost Information, Alameda County, January, 1975

1. Systems Feasibility:

a. Collection

1) Technical

a) The major portion of solid waste collection is labor intensive.
b) Improved loading and compaction systems permit larger containers and larger payloads allowing greater efficiency.

2) Economic

a) Capital costs: $3,000 to $4,200 per ton of daily capacity.
b) Operating costs: $31.00 to $48.00 per ton, depending largely on crew size.

3) Institutional

a) A number of unrelated physical and social factors have caused labor intensive collection methods to become well established.
b) Approximately 750 to 850 persons are employed in the existing collection system contributing to employment in Alameda County.

4) Environmental

a) Significant impact on weighted community noise levels due to early hour of collection.

5) Energy Usage

a) Ranges from 115,000 to 165,000 BTU per ton depending mostly on topographic and geographic factors.

b. Transfer Station

1) Technical

a) Proven technology up to 2,000 tons per day.
b) Relatively uncomplicated materials handling.

2) Economic

a) Capital Cost: $1,000-$2,000 per ton daily capacity
b) Operating Cost: $1-$4 per ton
c) Transfer system is favored economically where there is a significant amount of solid waste generated and collection trucks must travel over $28^{\pm}$ miles to dump.

3) Institutional

a) Compatibility with other land uses may present problems in terms of additional heavy traffic, noise, and perhaps odors.
b) Provides County residents with close-in facility for handling municipal-type refuse--an advantage.

4) Environmental

a) Feasible; localized noise may exceed the ambient levels.
b) Can be located in already industrialized areas and does not have to utilize open space lands.

5) Energy Usage

a) Ranges from 15,000 to 115,000 BTU/ton depending on the amount of processing done.
b) While a transfer station per se is a net user of energy, it is a necessary step if other systems such as resource recovery and long hauling, which conserve and even produce energy, are to be possible.

c. Materials Recovery

1) Technical

a) Ferrous metal separation proven at full scale.
b) Separation of other materials demonstrated at pilot plant scale.
c) Materials separated must meet minimum quality specifications.

2) Economic

a) Capital cost: $1,500 to $4,000 per ton daily capacity, depending on types of materials separated.
b) Operating cost: Estimates range from a cost of $2 per ton to a net revenue of $5 per ton.
c) The operating cost/revenue is highly sensitive to the fluctuations in value of the recovered materials.
d) Revenues from secondary materials must be allocated to benefit system users.

3) Institutional

a) Segments of the economy now committed to virgin resource extraction may resist the intrusion of recycled materials into the market.
b) Will need to be considered in conjunction with a transfer station and possibly with energy recovery facility.
c) May be a question of ownership of recovered materials. (See 2d)

4) Environmental

   a) For each ton of municipal solid waste separated, up to 300 pounds of materials are conserved.
   b) Materials recovery has high public acceptability.

5) Energy Use

   a) Depending on system complexity, from 180,000 to 285,000 BTU's per ton.

d. Energy Recovery

1) Technical

   a) Processes producing oil (Garrett), methane (Purox), electricity (CPU 400), steam (supplemental firing), are being developed at pilot scale; they are not proven at industrial scale.
   b) Processes converting refuse to non-solid fuel are favored.
   c) System design is predicated by market demand.
   d) Effectiveness of selected system may be affected by future composition of solid waste.

2) Economic

   a) Total capital requirements is estimated between twenty-five and fifty million dollars.
   b) Financing by private industry is questionable, due to credits recoverable or profitability of system; i.e., excessive risk.

3) Institutional

   a) Pyrolysis is being investigated by PG&E, EBMUD, and Oakland Scavenger Company for technical feasibility and implementation.
   b) Management of facility needs high technical sophistication.
   c) Planning, design, and construction periods are long.
   d) There is a nation-wide need for alternative sources of energy due to scarcity/costliness of existing energy sources.
   e) An inter-governmental structure for coordinating energy recovery implementation must be developed.

4) Environmental

   a) Pyrolytic processes tend to be "clean" environmentally.
   b) Some problems with air and water pollution for combustion processes exist.
   c) Storable energy supply is preferable.
   d) Landfill requirements can be reduced.
   e) Facility site locating is easier than for landfill or incinerator; metropolitan and urban location is favored because of assured flow of waste to plant.

5) Energy Usage

a) Net gains of approximately 5-7 M BTU/ton is realized with energy recovery. (Source: Stanford Research Institute) (M=Million)
b) Supplemental firing produces approximately 8.5 MM BTU/ton when used to produce steam.

e. Long Haul Transportation

1) Technical

a) Feasible, presents no major problems.

2) Economic

a) Capital cost: depends on length of haul. New trucks of 25 ton capacity cost $60,000. Cost per ton of daily capacity ranges from $150 to $2,400, depending on closeness of disposal site.
b) Operating costs: also depends on length of haul; ranges from 8 cents to 13 cents per ton per mile, one way. In comparison, operating cost for a 2- or 4-man collection truck is about 18 cents to 26 cents per ton per mile.

3) Institutional

a) Feasible; it must be coordinated with transfer materials recovery and disposal operations.

4) Environmental

a) Additional truck traffic will contribute to traffic congestion, noise, and air pollution. A typical 1,500 ton-per-day operation will require 60 truck loads per day with the same 60 trucks returning for a total of 120 additional trucks in the vicinity of the transfer station and the disposal site.

5) Energy Use

a) In the distance where long haul transportation is indicated (28-45 miles), the energy usage is about 820 BTU's per ton per mile. Hauling in a collection vehicle uses four or five times this amount of energy.

f. Conventional Landfill Disposal

1) Technical

a) Well established and documented technology.

2) Economic

   a) Least cost to the consumer when landfill is close-in.
   b) Land acquisition costs as well as development costs are significant for remote sanitary landfill.

3) Institutional

   a) Public ownership is taxfree and non-profit; low interest rates and government grants may provide financing advantages.
   b) Public enterprise approach to disposal operations could combine advantages of both government and private enterprise (flexibility).
   c) Disposal operations could be leased to a private operator while land is in public ownership.

4) Environmental

   a) Serious problems arise in location of a landfill.
   b) Operational controls must be constantly watched and adhered to in order to prevent a sanitary landfill from becoming a dump or adversely affecting the natural environment.

5) Energy Usage

   a) Landfilling accounts for a net loss of 8-10 million BTU/ton (cost) when waste is untreated and disposed at close-in sites.
   b) Transfer stations use about 25,000 BTU per ton in processing for long haul; transfer to landfill in long haul vehicle uses about 63,000 BTU/ton (cost). (Source: Stanford Research Institute)

2. Cost Information:

a. <u>Collection</u>

The urban collection system consists of residential and commercial routes. Most municipal collection is made by packer and front-end loader trucks, and the following cost information is sufficiently general so as to be applicable to either truck system. The costs associated with the collection truck itself do not change substantially with different crew sizes, but the costs of different crew sizes are different and result in significantly changed costs of refuse collection. The 2 3/4 man crew size is included because statistically, this is the average crew size in Alameda County.

Collection Costs

1. Capital Costs

a.	Collection vehicle, approximately 5 ton capacity:	$30,000
b.	Six tires @ $150 each:	- 900
c.	Collection vehicle less tires:	$29,100
d.	Fenced parking area for 20 vehicles prorated to one:	+ 710
e.	Total capital cost:	$29,810

2. Time Operating Costs - Per Year

a.	Depreciation, straight line, six years:	$ 4,850
b.	Interest on capital @ 10%:	2,980
c.	Taxes and licenses:	800
d.	Fuel for compacting, $0.56 per gallon and 1 gallon per hour:	940
e.	Insurance:	900
f.	Overhead, office:	2,000
g.	Franchise @ 6% of gross receipts:	6,900
h.	Dump charges @ $2.56/ton:	5,490
i.	Total per year:	

3. Salaries and Fringe - Per Year

		Crew Size		
		2	2.75	4
a.	Driver's salary:	$16,800	$16,800	$16,800
b.	Crew salary:	14,400	25,200	43,200
c.	Fringe @ 25% of salaries:	7,800	10,500	15,000
d.	Total:	$39,000	$52,500	$75,000

4. Total time and salary costs

		Crew Size		
		2	2.75	4
a.	Per year:	$63,860	$77,360	$99,860
b.	Per minute:	$0.51	$0.62	$0.80

5. Usage Costs - Per Mile

		$/Mile
a.	Fuel, 45¢ per gallon and 4 miles per gallon:	0.1125
b.	Oil, $3 per gallon and 5,000 miles per gallon:	0.0006
c.	Tires, 4 rear @ $150 and 20,000 miles:	0.0300
	2 front @ $150 and 30,000 miles:	0.010
d.	Repair and maintenance:	0.0700
e.	Total:	$0.2230

Using the same average statistics for the County, several general cost estimates can be made. The average collection crew travels about 45 miles per 8-hour day and collects an average of 8¼ tons of solid waste, 260 days per year.

6. Typical Collection Costs

a.	Time cost, 2-man crew, per year:	$ 63,860
b.	Time cost, 2.75-man crew, per year:	77,360
c.	Time cost, 4-man crew, per year:	99,860
d.	Usage cost, $0.223 per mile, 45 miles per day, per year:	2,610
e.	Annual collection cost, 2-man crew:	$66,470
f.	Annual collection cost, 2.75-man crew:	79,970
g.	Annual collection cost, 4-man crew:	102,470
h.	Collection cost per ton, 2-man crew:	$30.99
i.	Collection cost per ton, 2.75-man crew:	37.28
j.	Collection cost per ton, 4-man crew:	47.77

In summary, the cost of collection service ranges from $31.00 up to $48.00 per ton depending on crew size. It must be emphasized that this is for collection service which includes $2.56[1] per ton in disposal charges which are intended to at least partially offset the cost of operating the disposal site. In the analysis of disposal costs, notice that the $2.56 per ton re-appears as a credit.

b. Transfer Operations

For the purposes of this report, the costs associated with developing the three different cases likely to be used were examined. Each case was considered to be appropriate for serving one portion of the County waste management system. Transfer stations are basically materials handling operations which only can be justified when a cost savings may be realized through improved system efficiency. With the closing of close-in landfills, transfer and long haul will become a necessity.

Transfer station one consists of a simple enclosed area designed to handle 1,000 tons per day, 260 days per year. Collection vehicles line up along a pit area for dumping; a cat pushes refuse to a funnel shoot leading to the transfer vehicle loading area. A stationary back hoe distributes the load equally throughout the trailer. At the landfill, tilt-type dumpers similar to those used at Mt. View Disposal are required for off-loading.

Transfer station two is also designed for 1,000 tons per day, 260 days per year and includes additional material handling equipment to shred and air classify into a "light" and "heavy" fraction. Additional space will be needed to house this equipment.

Another transfer operation selected for cost analysis is the 1,000 tons per day, 260 days per year operation consisting of an enclosed building shredder and magnetic separation.

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[1]Based on information supplied to Alameda County from Oakland Scavenger Company, August 28, 1974, concerning the company collection operations.

While material recovery may be an integral part of any transfer station, it will be discussed separately below. The problem of assigning costs and credits to either the transfer or the material recovery operation has only been partially answered in the variation between the design differences in the three alternatives discussed here. Although a transfer station need not include air classification or even shredding, there is a problem in deciding when the machine becomes transfer station equipment or resource recovery equipment. When comparing alternate systems which include both transfer and material recovery equipment, the problem may be circumvented by combining transfer and material recovery costs before comparing.

TRANSFER STATION COSTS

	TS#1	TS#2	TS#3
I. CAPITAL COSTS			
1. Cost of Structure @ $21/sq. ft.			
Dumping & Pit Area	$420,000	$ 420,000	$ 420,000
Processing Area	63,000	95,550	121,280
Sprinklers @ $1.15/sq. ft.	26,450	28,230	29,640
Total Cost of Structure(s)	$509,450	$ 543,780	$ 570,920
2. Cost of Equipment (Installed)			
Truck Scale	$ 38,800	$ 38,800	$ 38,800
Track-Type Tractor	140,000	140,000	140,000
Tilt-Up Dumper	88,700	88,700	88,700
Stationary Backhoe	26,000	26,000	26,000
2 Shredders		467,000	467,000
2 Air Classifiers		353,600	
2 Magnetic Separators			34,500
Conveyors as Required		340,900	205,700
Total Cost of Equipment	$293,500	$1,455,000	$1,000,700
3. Cost of Land, 10 Acres Required			
@ $30,000/Ac.	$300,000		
@ $20,000/Ac.		$ 200,000	
@ $50,000/Ac.			$ 500,000
4. Cost of Site Improvements			
Roads, 1 Mile @ $17/Ft.	$ 89,800	$ 89,800	$ 89,800
Landscaping		25,000	10,000
Total Cost of Site Improvement	$ 89,800	$ 114,000	$ 99,800
5. Total Capital Costs	$1,192,750	$2,213,580	$2,171,420

TRANSFER STATION COSTS (Continued)

II. ANNUAL OPERATING COSTS	TS#1	TS#2	TS#3
1. Depreciation of Capital Items			
Structures (20 Yrs.)	$25,470	$ 27,190	$ 28,550
Roads (10 Yrs.)	8,980	8,980	8,980
Equipment (5 Yrs.)	58,700	291,000	200,140
Total Depreciation Cost	$93,150	$327,170	$237,670
2. Interest @ 10% of Capital Cost	$119,280	$221,360	$217,140
3. Labor Including Fringe			
Foreman @ $30,000/Yr. Gross	$	$ 37,500	$ 37,500
Operator @ $11.60/Hr. Gross	30,160	30,160	30,160
Other @ $8/Hr. Gross	20,800	41,600	41,600
Total Labor Cost	$50,960	$109,260	$109,260
4. Maintenance			
Tractor	$21,600	$ 21,600	$ 21,600
Shredders @ $0.50/Ton		260,000	260,000
All Other @ 6% of Capital	45,170	84,390	63,870
Total Maintenance Cost	$66,770	$365,990	$345,470
5. Miscellaneous Operating Costs			
Fuel & Oil for Tractor, $3.95/Hr.	$ 7,190	$ 7,190	$ 7,190
Electricity @ 1½¢/kwh	840	47,640	26,450
6. Insurance @ 0.18% of Capital	$ 1,610	$ 3,620	$ 3,010
7. Taxes @ $12/$100 Assessed Value	35,780	66,410	65,140
8. Total Annual Operating Cost	$375,580	$1,148,640	$1,011,330
9. Operating Cost Per Ton	$1.44	$4.42	$3.89

c. Processing-Materials Recovery

A materials recovery operation, if included in a solid waste management system, will most likely be closely coupled to a transfer station. The two attached itemized estimates give some idea of the capital and operating costs of a 1,000 ton per day material recovery plant. To compare the two estimates, they must first be put on an even basis. From the Stanford Research Institute (SRI) estimate of $4.29 per ton production cost, the $0.41 per ton disposal cost must be subtracted, leaving $3.88 per ton as the net production cost. The Alameda County Planning Department estimate of $6.55 per ton includes complete transfer facilities and thus, $1.44 per ton (minimum cost of transfer facilities) must be subtracted leaving $5.11 per ton as the net production cost. With these changes, the two estimates are now of comparable material recovery systems.

Table VI-1

ESTIMATED MATERIALS RECOVERY COSTS

Estimate by Source	Material Recovery Isolated		Material Recovery With Transfer	
	$ Million	Production $/Ton	$ Million	Production $/Ton
SRI: (Refuse as a Fuel for Utilities)	$4.1	$3.88	$5.3	$5.32
ACPD: (Based on NCRR Estimates of Equipment & Costs + Inflation)	$2.4	$5.11	$3.6	$6.55

The purpose of the plant is to recover materials from the solid waste. The value of these materials when sold acts as a credit to reduce the operation/production cost. Since the operation costs will remain relatively constant and the credits from sale of recovered materials may be unpredictable, it is prudent to keep the two figures separate. The following table shows the expected range of not only amounts of recovered materials, but also the range of prices that might be anticipated.

Table VI-2

VALUE OF RECOVERED MATERIALS

Material	Tons Recovered Per Ton Input	Value Per Ton	Value Per Input Ton Minimum/Maximum	Value Per Input Ton Expected
Ferrous Material	0.047-0.076	\$ 10-\$ 20	\$0.47-\$1.52	\$1.26
Aluminum	0.005-0.007	\$200-\$300	\$1.00-\$2.10	\$1.80
Other Nonferrous	0.001-0.004	\$250-\$500	\$0.25-\$2.00	\$0.75
Glass*	0.040-0.064	\$ 1-\$ 10	\$0.04-\$0.64	\$0.16*
News & Corrugated*	0.000-0.040	\$ 2-\$ 50	\$0.00-\$2.00	\$0.40*
Total	---	---	\$1.76-\$8.26	\$4.37

*Glass and News/Corrugated will be treated as optional in the analysis below because the major factor in determining what their expected value per ton input is not the technical or market factors but whether or not the materials recovery system will include the equipment and labor to sort out these materials due to their low return rates. The expected value per input ton if glass and paper are not sought would be \$3.81.

The net operational cost for the transfer/materials recovery facility is the production cost minus the credit for materials recovered and is given in the following table:

Table VI-3

NET OPERATING COST FOR TRANSFER/MATERIALS RECOVERY FACILITY

Estimate	Production \$/Ton	NET OPERATING COST (\$/TON) Maximum	Minimum	Expected	Expected Without Glass & Paper
SRI	\$3.88	\$2.12	-\$4.38	\$0.49	\$0.07
ACPD/NCRR	\$5.11	\$3.35	-\$3.15	\$0.74	\$1.30

The above figures isolate the cost of material recovery for schematic or theoretical purposes. As mentioned above, material recovery facilities are normally built along with transfer station facilities. To reflect the operating cost of the combined plant, \$1.44 per ton (minimum cost of transfer) could be added to each of the figures in the above table.

Capital Cost: \$4.1 million.

PRODUCTION COSTS
FOR REFUSE SEPARATION (FRONT END) PLANT
(Costs to Process 7,000 Tons per Week of Refuse)

	Basis or Unit Cost	Total Costs per Year (dollars)
Direct operating costs		
Labor		
Operators (not including maintenance)	7 Operators at $12,100 per yr. plus 30% fringe benefits	$ 110,100
Laboratory	10% of above	11,000
Maintenance	180% of operator labor	168,700
Total Labor		$ 319,100
Materials		
Maintenance	15% of plant investment	210,000
Operating		6,000
Total Materials		$ 216,000
Utilities	Electricity at 1.0¢ per kWh	160,000
Residual Disposal	$2.00 per ton	148,000-$0.41/ton
TOTAL DIRECT OPERATING COST		$ 843,100
Overhead	80% of labor	255,200
Insurance	1% of plant investment	19,100
Plant Cost		$1,117,400
Amortization	20 yrs. at 6% on $5.09 million	443,500
TOTAL PRODUCTION COST		$1,560,900-$4.29/ton
By-product Credit		
Ferrous Metal	47 tons/day, 365/yr. at $20 per ton	343,000
Aluminum	6 tons at $200 per ton	438,000
Other nonferrous metal	1 ton at $500 per ton	182,500
Glass	40 tons at $10 per ton	146,000
Total Credits	94 - 9% Resource Recovery	$1,109,500-$3.05/ton
NET PRODUCTION COST		$ 451,400-$1.24/ton

Source: Stanford Research Institute, Refuse as a Fuel for Utilities, prepared for Pacific Gas & Electric Co., December, 1974.

MATERIALS RECOVERY SYSTEM COSTS

(Based on NCRR Estimates of Equipment & Cost)

I. Capital Equipment Required to Dovetail with TS#2, Page 7

1. Cost of Structure:	
21,000 sq. ft. @ $21/sq. ft.	$441,000
Sprinklers @ $1.15/sq. ft.	24,150
Total Cost of Structure	$465,150
2. Cost of Equipment (Installed)	
Magnetic separator	$ 25,870
Air knife	6,470
Rising current classifier	73,730
Secondary shredder	44,540
Screen	14,600
Heavy media separator	174,080
Magnetic drum separator	6,650
Dryer	46,750
Roll crusher	27,160
Screen	13,310
Electrostatic separators	99,230
Optical separators	41,760
Required conveyors	74,750
Miscellaneous, vehicles, parts, furniture, etc.	191,630
Total Cost of Equipment	$850,530
3. Cost Land (In Conjunction with Transfer Station)	$ 0
4. Site Improvements (In Conjunction with Transfer Station)	
Roads	$ 0
Landscaping	5,000
5. Total Capital Costs	$1,310,680

II. Annual Operating Costs

1. Depreciation of Capital	
Structure (20 Yrs.)	$ 23,260
Equipment (5 Yrs.)	168,100
Total Depreciation	$191,370
2. Interest @ 10% of Capital	$131,070

3.	Labor Including Fringe (2 Shifts)	
	Operators @ $14.50/hr.	$ 60,320
	Clerk	15,000
	Mechanics	33,250
	Pickers	24,020
	Foreman	30,000
	Total Labor Costs	$162,590
4.	Utilities 5,435,000 kWh @ 1½¢/kWh	$ 81,525
5.	Miscellaneous Supplies, Gas, Fluids, Telephone, etc.	$ 22,440
6.	Insurance @ 0.18% of Capital	$ 2,350
7.	Maintenance Material @ 2½% of Capital	$ 32,770
8.	Taxes	$ 39,320
9.	Total Operating Costs/Year	$663,430
10.	Operating Cost/Ton	$2.55

Combining with Transfer Station #2:

Total Capital Investment	$3,591,100
Operating Costs/Year	$1,703,680
Operating Cost/Ton	$6.55

d. Processing - Energy Recovery

The technology of energy recovery is still in its infancy. In many cases, only laboratory scale models have been developed and tested. In several instances, larger models have been built for testing or are now being built. Several promising systems for energy recovery were selected for study by SRI in Menlo Park.[1] Selection criteria used at SRI narrowed the consideration of advanced processes to the following:

The Garrett Process (oil)
Monsanto (Landgard) Process (gas, steam)
Union Carbide Purox Process (gas)
Combustion Power Process (electricity)
Incineration

[1] Refuse as a Fuel for Utilities, Stanford Research Institute, Menlo Park, California, December, 1974.

In the table Comparison of Processes, 1974, which follows, some technical and economic data on the seven processes surveyed by SRI are presented. Looking at the last figure in each process column, net production cost (- credit) per ton of refuse, two processes stand out because they are both predicted to show a monetary return, namely preparation of a solid waste fuel and Union Carbide Purox. In spite of the indicated economic benefits of the solid waste fuel alternative, Pacific Gas & Electric Company (PG&E), which had contracted for the SRI study, decided that the Purox process was more promising from a technical and environmental viewpoint. PG&E contracted again, this time with the Ralph M. Parsons Company of Los Angeles, for a detailed engineering study[1] to verify that the Union Carbide Purox process appeared technically and economically feasible.

The cost data developed by SRI and used by PG&E to select the Purox process is now considerably out of date. For example, the SRI study in 1974 shows the capital cost of the direct utilization of the Purox gas as $19.6 million. The Ralph M. Parsons study done less than one year later reveals the capital cost of the same plant had risen to $28 or $29 million, a 45 percent increase. The Parsons study was admittedly more detailed and could have uncovered some costs not found in the broader study by SRI, but inflation is certainly the major reason for the 45 percent increase in capital requirements. All of the seven processes presented in the Comparison of Processes, 1974, table below may be increased by 25 percent to 50 percent to obtain more realistic capital costs for 1975. Production costs will also increase due to these changes but no generalization would be useful as to the amounts.

A great deal of knowledge was added to the study of energy recovery from solid wastes with the publication in March, 1975, of the East Bay Energy & Resource Recovery System Feasibility Study Report (EBERRS Report), prepared by the Ralph M. Parsons Company. The EBERRS Report was made at the request and expense of PG&E and East Bay Municipal Utility District (EBMUD) in association with the Oakland Scavenger Company (OSC). The energy recovery system studied, the Union Carbide Purox system, appeared to have the feasibility to (1) provide an alternate source of energy for PG&E, (2) provide a less expensive and environmentally safe means of disposing of sewage sludge from EBMUD, one of Alameda County's largest producers of solid waste, and (3) reduce the amount of solid waste to be disposed thus preserving local landfill capacity. Most importantly, the general public benefitted from the first in-depth review of the kind of system needed for comprehensive solid waste management.

The EBERRS Report presented and compared the projected economics of four alternative uses of the syngas from the basic Purox plant. First, consideration was given to building a small distribution system and

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[1] East Bay Energy & Resource Recovery System, Ralph M. Parsons Company, Los Angeles, California, March, 1975.

Table VI-4

COMPARISON OF PROCESSES

1974

	Garrett	Union Carbide Purox	Monsanto Landgard	Combustion Power CPU-400	Preparation of Solid Waste Fuel[1]	SNG (877 Btu/scf) from Methanation of Purox Off-Gases	SNG from Purification of Landfill Gases[2]
Refuse rate, tons/day (average over 365 days/year)	1,000	1,000	1,000	1,131	1,000	1,000	1,000
Combustibles in as-received feed, wt% (ash and moisture free)	56	56	56	44	56	48	56
HHV of as-received feed, Btu/lb	5,000	5,000	5,000	3,200	5,000	4,300	5,000
Product fields, per 1,000 tons of feed							
Dry fuel gas, tons		741	2,445			173	
Water-free liquid fuel tons	261						
Dry ash-free solid combustibles					478		
Electricity, kWh				745,000			
Magnetic, tons	49		~52	52	47		47
Aluminum, tons	6			7			6
Glass, tons	41			52			40
Glass aggregate, tons		186	~134			268	
Plant investment, millions of dollars	$15.1	$16.0	$16.0	$20.0	$4.0	$19.4	$6.9
Total capital, millions of dollars	$18.6	$19,6	$19.8	$24.4	$5.2	$23.7	$9.4
Net production cost (after by-product credit)[3]							
Costs, thousand dollars/year	$4,858	$4,195	$5,030	$5,365	$1,906	$5,424	$3,152
Credits, thousand dollars/year	$3,731	$4,240	$4,071	$4,146	$4,321	$2,992	$2,536
Cost-credits, dollars/ton of refuse	$3.08	-$0.12	$2.63	$2.95	-$6.62	$6.66	$1.69

[1] For supplemental firing of existing gas- or oil-fired boiler.

[2] At possible gas generation rate which is approximately 5 times the probable gas generation rate.

[3] Net energy value for fuels taken at $1.36/million Btu, for electricity 1¢/kWh.

SOURCE: Stanford Research Institute, Refuse as a Fuel for Utilities, Prepared for Pacific Gas and Electric Company, San Francisco, California, December, 1974.

delivering the low BTU syngas directly to nearby industrial customers. Another alternative was to convert the syngas into high BTU methane gas suitable for injecting into the existing natural gas distribution system. A third alternative was to generate electric power by feeding the syngas into a gas and/or steam turbine(s) connected to electric generators. The last alternative considered was to convert syngas into liquid methanol, a commonly used industrial chemical and fuel. The following pages from the EBERRS Report summarize the study results; the production costs of the four alternatives are shown with the variables of (1) whether or not there is a charge to deliver refuse to the plant (drop charge); (2) location of the plant; (3) public or private financing; and (4) first year start up costs vs. average cost over the plant's 20-year life.

2.7 FINANCIAL ANALYSIS RESULTS[1]

Public and private financing methods of the project were analyzed. The major difference being that public financing shows only the production cost and private financing, for this case, includes production costs plus return on investment. The results are summarized in Section 11, and the following are compared for public financing:

- 1974 unit production costs for the four utilization processes for a 1750-TPD plant.
- Plant location costs at Davis Street versus the Yerba Buena Avenue site.
- Cost of production with and without a \$5-per-ton refuse drop charge.

Figure 2-3 shows that the production cost at Davis Street for syngas per 10^6 Btu is \$1.74 based on 1974 costs; the cost of methane per 10^6 Btu is \$2.78; electric power, \$0.0255/kW-hr; and methanol \$0.22/gal. Comparable costs at Yerba Buena are 6% to 12% higher than at Davis Street.

Figure 2-4 shows private financing costs of a 1750-ton plant at Davis Street and compares:

- First and 20-year leveled financing costs.
- Costs for the four utilization processes.
- Costs based on September 1974 prices and inflated costs based on a January 1978 production start data.
- Costs with and without a \$5 drop charge.

[1] EBERRS Report, Ralph M. Parsons Company, Sections 2.7 and 2.8 and Figures II-1 and II-2, March, 1975.

-FMP-

The figure also shows that the production costs in terms of 1974 dollars are:

	1st Year	20-Year Leveled
Syngas/10^6 Btu	$2.61	$3.30
Methane/10^6 Btu	4.21	5.32
Electric Power/kW-hr	0.0391	0.0490
Methanol/gal	0.33	0.42

Since September 1974, significant changes in the U.S. economy have occurred. From a period of tight supply and rapidly escalating prices, the country is entering an unstable period with possible moderation in the rate of inflation. Parsons has reviewed the inflation rates used in this report and has decided that it is inappropriate to modify them. However, in recognizing the uncertainty of future prices given the existing economic instability, Parsons recommends that the inflation rates be reviewed periodically and that appropriate adjustments be made.

2.8 CONCLUSIONS

The following conclusions can be drawn from this report:

(1) The Purox gasifier will be operationally viable, as indicated from information and data furnished by UCC; however, a final determination awaits completion of operation and testing of the 200-TPD demonstration plant at South Charleston, West Virginia.

(2) The Purox reactor is similar to technology long used in blast furnaces, coke oven gas generators, and partial oxidation of petroleum products. UCC has designed a configuration and operational mode that was successfully tested over 3 years in an 18-inch diameter, 5-TPD pilot unit and initially successfully tested in current operation of a 200-TPD demonstration plant. This leads to confidence in UCC's ability to complete its tests successfully in 1975 and to furnish reliable equipment for commercial plants, if constructed over the next 3 or 4 years.

(3) The synthetic gas produced can be utilized directly as a furnace fuel, converted to methane for injection into existing pipeline distribution systems, converted to methanol for use as a fuel or as a chemical feed stock, or used to generate electric power in a gas/steam turboelectric system. Systems and equipment for such utilization are commercially available.

(4) The utilization of syngas piped directly to interruptible class industrial consumers appears to be commercially attractive in the light of anticipated increases in the costs of energy from other sources. This is particularly true if the facility were financed by public funds.

-RMP-

(5) Based on today's prices for chemical grade methanol, the methanol plant is commercially feasible. A market analysis is required to establish the long-term price picture. It is probable the sale price will remain high because methanol is presently derived from petroleum liquids and natural gas.

(6) The conversion of syngas to methane is economically comparable to the cost of methane produced from coal.

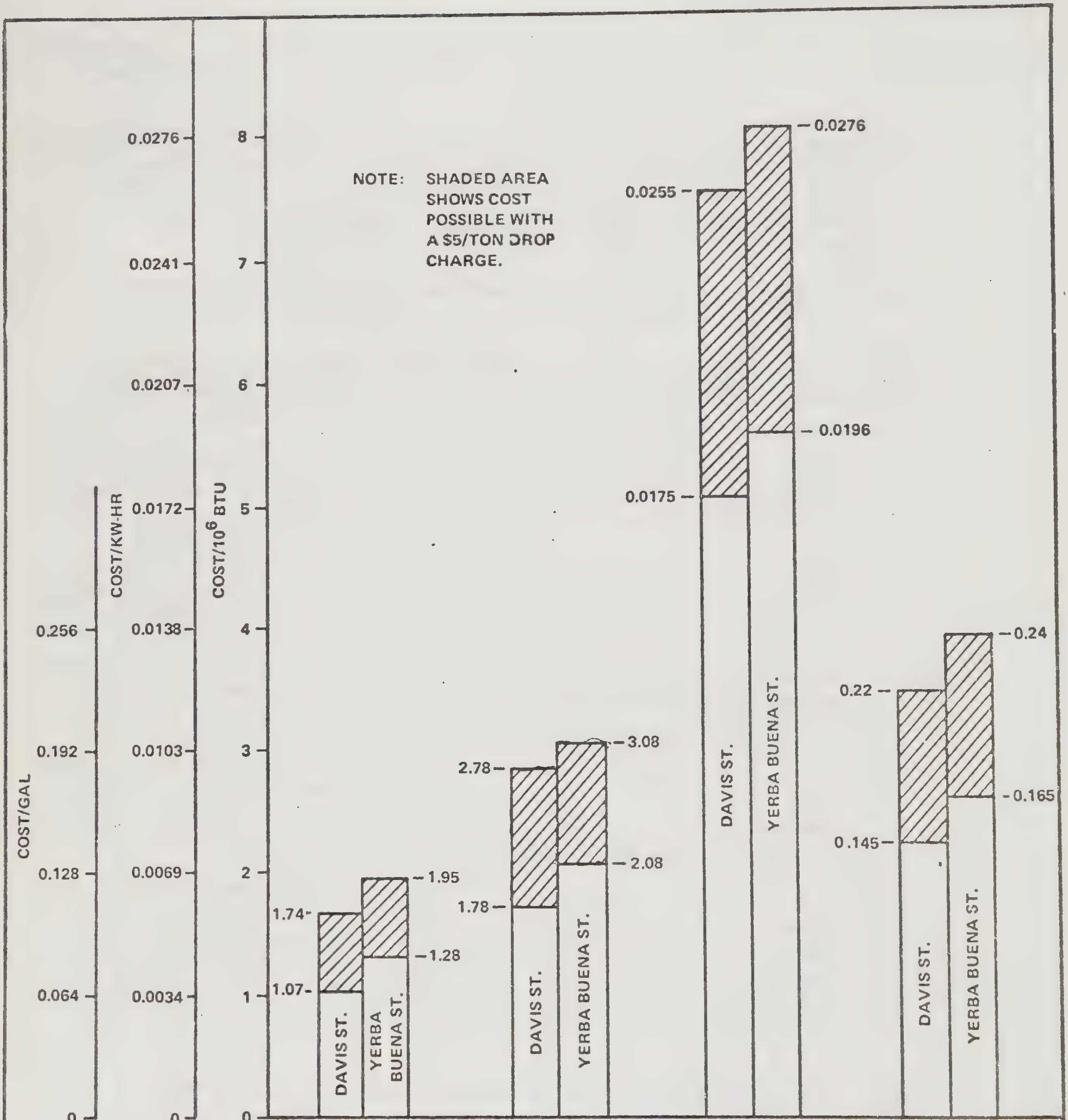
(7) Electric power generation from syngas does not appear practical because of high unit product cost. The energy conversion efficiency of this system is the lowest of all those considered.

(8) Public funding of the facility reduces costs significantly because of the lower interest rates involved and in some cases may make the system economically feasible.

(9) Digested sewage sludge from EBMUD added to the solid waste can be cleanly disposed of when fed to the Purox reactor. The amount of sewage solids that can be accommodated in a 1750-TPD plant is approximately 3% and the associated water increases the moisture in the feed from 25% to 32%. The organic fraction in the digested sewage sludge possesses just enough energy for evaporation of its water fraction; 35% more heat is needed to scrub out the additional CO_2 generated if the syngas is to be synthesized to methane or methanol. Raw sewage sludge provides 50% more energy than is required to evaporate its water fraction and is a more desirable feed material. However, it also constitutes a health hazard and requires special handling.

(10) The optimum-sized plant for location at Yerba Buena or Davis Street is 1750 TPD, since the products are less costly to produce than that for a 1400-TPD plant and approximately the same as for a 2100-TPD plant. Additionally, the guaranteed feed material delivery rate is 1500 to 1800 TPD. Although 2100 TPD is the maximum available from OSC, this amount is not continuously available.

(11) The Davis Street site is preferred because of a lower cost product. It is the planned location of OSC's new refuse processing plant, and to keep the two plants in close proximity, the land for the syngas plant has been offered at no cost. At Yerba Buena, land will need to be purchased and shredded refuse must be transported from the Davis Street location. Additionally, the cost of a direct syngas distribution network is substantially less at Davis Street.



	SYN GAS	METHANE (SNG)	ELECTRIC POWER	METHANOL
DAVIS ST.	$/$10^6$ BTU	$/$10^6$ BTU	$/KW-HR	$/GAL
1977 - NO DROP CHARGE	2.26	3.63	0.0334	0.29

Figure 11-1 - 1750-TPD Plant -
Public Financing
(1974 $)

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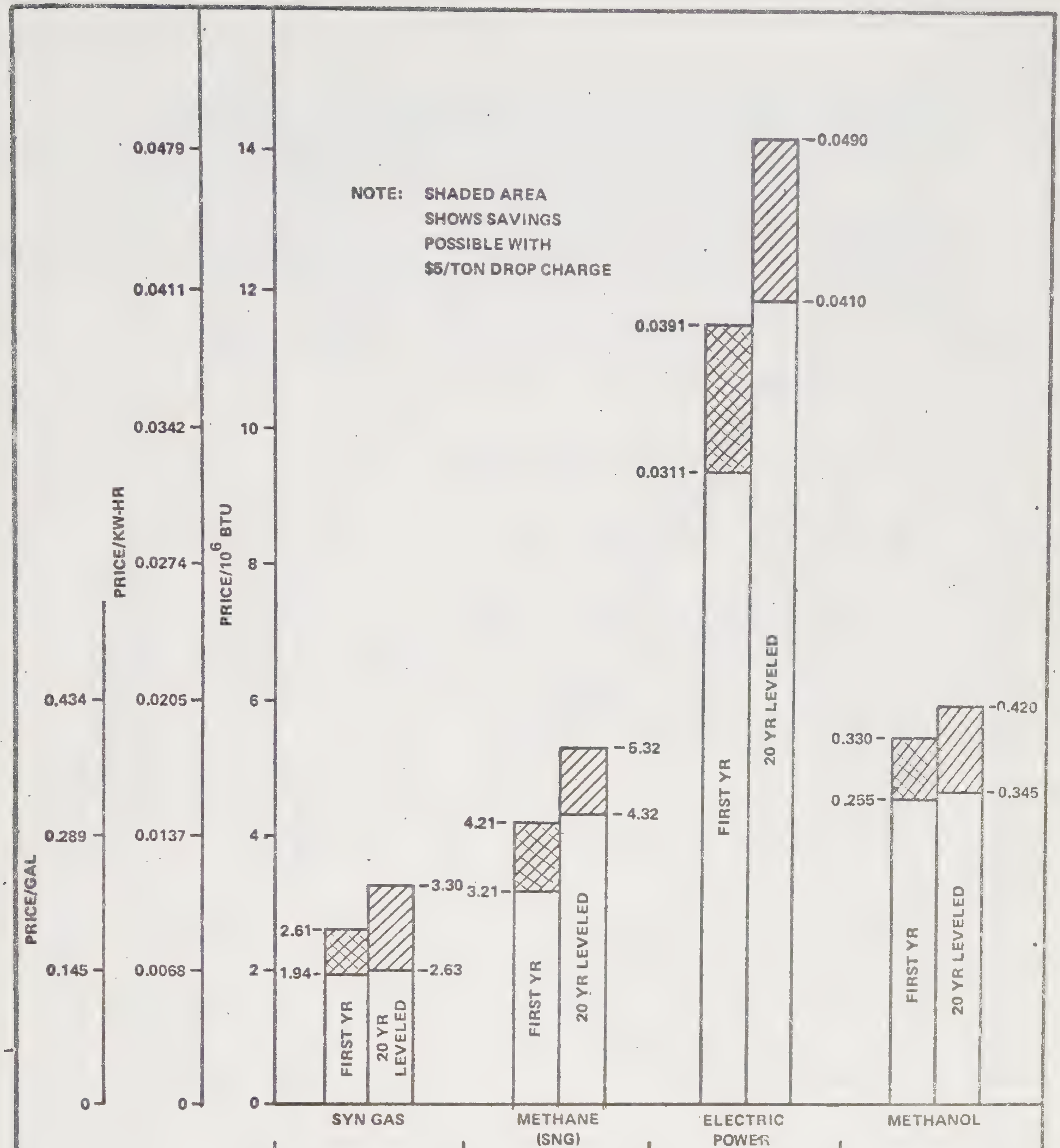


1977 $ - NO DROP CHARGE	$\$/10^6$ BTU	$\$/10^6$ BTU	$/KW-HR	$/GAL
FIRST YR	3.48	5.64	0.0525	0.440
20 YR LEVELED	4.34	7.03	0.0650	0.550

Figure 11-2 - 1750-TPD Plant -
Private Financing
(1974 $)

e. Long-Haul Transport

Long hauls consist of the transport of processed or unprocessed refuse between the transfer station and the landfill. It is accomplished by loading large capacity (25 ton) trucks at the transfer point, haul to the landfill and emptying for the return trip. In the Bay Area, the SWETS system in use in San Francisco provides an excellent example of such an operation. Before taking a look at the specifics of what long haul configuration might look like in Alameda County, the owning and operating costs of a long-haul vehicle need to be discussed.

LONG-HAUL TRANSPORTATION COSTS

1. Capital Investment		
a. Long-haul tandem truck and trailers, 25 ton capacity	$60,000	
b. 18 tires @ $150 each	2,700	
c. Long-haul vehicle less tires	$57,300	
	8 Hrs. Per Day	**9 Hrs. Per Day**
2. Time Costs - Per Year		
a. Depreciation of capital investment, straight line, 6 years	$ 9,550	$ 9,550
b. Driver's salary @ $7.10/Hr., 260 Days/Yr.	14,770	17,540
c. Driver's fringe @ 25% of salary	3,690	4,380
d. Interest on vehicle @ 10%	5,730	5,730
e. Taxes and licenses	1,400	1,400
f. Insurance	2,000	2,000
g. TOTAL PER YEAR	$37,140	$40,600
h. Time cost/minute, 260 days/year	$ 0.30	$ 0.29
i. Same if operated 2 shifts	$ 0.22	$ 0.22

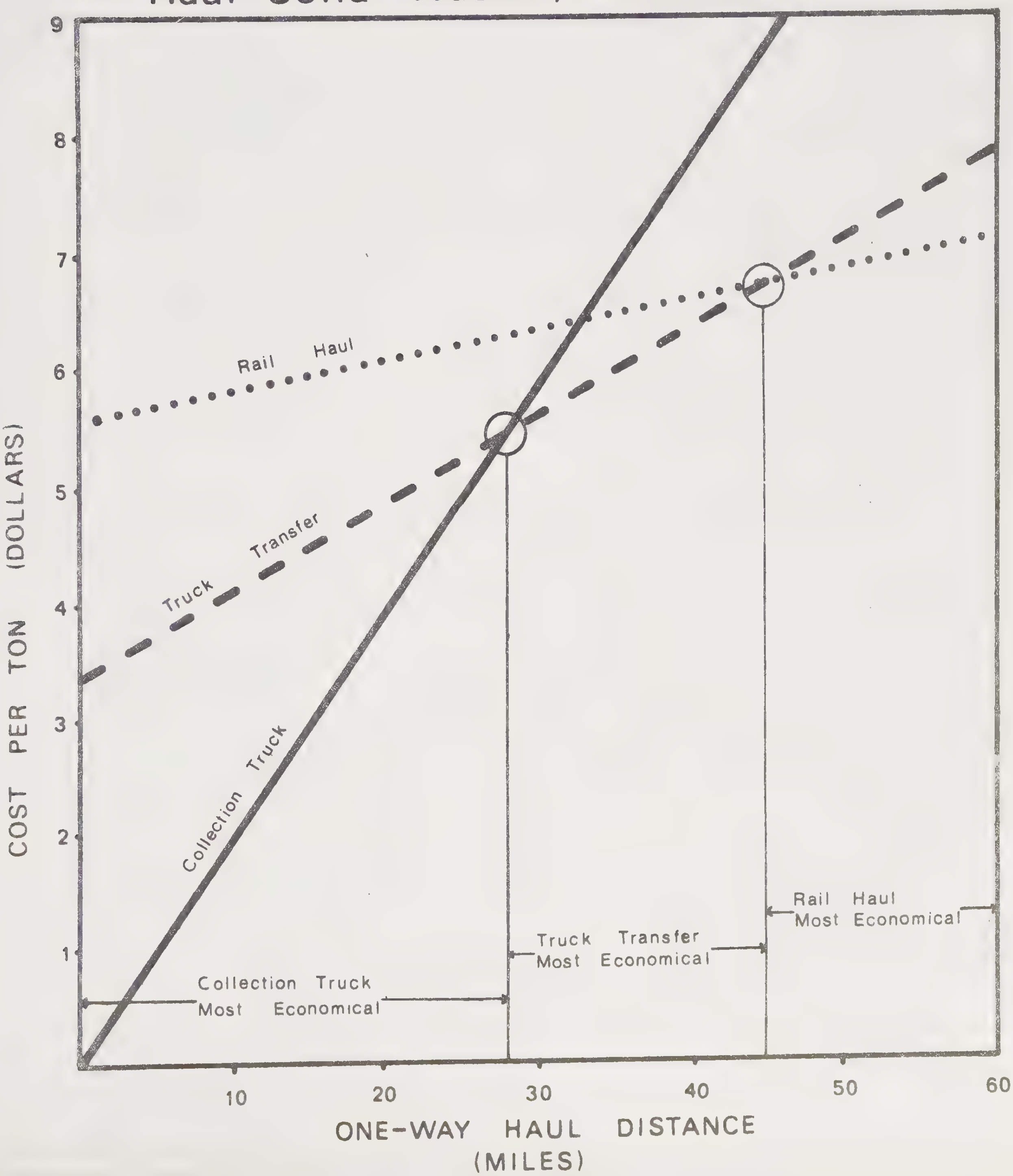
3. Usage Costs - Per Mile	
a. Fuel @ $0.45/gallon & 4 mpg	$0.1125/mile
b. Oil @ $3.00/gallon, 5,000 mpg	0.0006
c. Tires: 16 rear & trailer tires @ $150 per tire & 20,000 miles	0.1200
2 front tires @ $150/tire & 30,000 miles	0.0100
d. Repair & Mainenance	0.0700
e. TOTAL PER MILE	$0.313/mile

In assessing the needs for long-haul services in Alameda County, consideration must be given to the cost of transporting the waste from collection routes to a transfer station and the location of transfer stations. This is important because the cost of transport in collection vehicles greatly exceeds the long haul cost when the collection vehicles are required to travel large distances (or time) from the route to the tipping point. Substantial cost savings may

be realized through time by selection of transfer locations which take advantage of the various solid waste hauling systems. The following graph indicates the break-even points of the three common solid waste handling systems.

Figure VI-1

Economical Ranges of Three Ways to Haul Solid Wastes, Alameda Co., 1975.



Referring to previously published data on landfill capacity (Landfill Evaluation Report) and on waste quantities, the first transfer stations will be needed in the metropolitan Oakland area within one or two years. With the initiation of materials recovery at a centralized processing-transfer station, other parts of the County's wastes could be channelled through a coordinated transfer system, using long-haul vehicles.

Short distance haul in large capacity trucks costs 13-16¢ per ton mile. Long distance haul, greater than 30 miles, was computed at 7-8¢ per ton mile. Transport of refuse in collection vehicles costs 18-26¢ per ton mile.

f. Disposal Costs

Capital requirements for sanitary landfill may be divided into three categories:

- Land and Land Acquisition Costs
- Permanent Improvement Costs
- Equipment Costs

The major annual operating costs for a sanitary landfill are analyzed as follows:

- Equipment Ownership and Operation
- Depreciation of Permanent Improvements
- Interest on Borrowed Capital
- Labor
- Maintenance
- Taxes, Utilities, and Miscellaneous

In addition, a landfill operation will receive a credit other than revenue from disposal charges.

- Trade-in Value of Equipment

Taking the case of a remote 300-acre landfill in which the purchase price of the land is $400 per acre, a typical analysis of capital and operating costs would be as follows for an 800 tons-per-day, 360 days-per-year operation:

Capital Costs

Land, 300 acres @ $400/acre	$120,000
Transaction @ 10%	12,000
Permanent Improvements	
Roads, 3,600' @ $14/l.f.	50,400
Utilities, Electric, 3,600' @ $3.50/l.f.	12,600
Structure, 1,000 s.f. @ $11/s.f.	11,000
Applications & EIR	15,000

Equipment	
3 - 30 ton Crawler-Dozers	$440,100
1 - 32 ton Landfill Compactor	126,200
1 - 14 cu. yd. Dual Power Scraper	158,300
2 - 5,000 gal. Water Trucks	100,000
Total Capital Cost	$1,045,600

Annual Operating Costs

Equipment	
Ownership	$311,470
Operation (not always full-time)	333,110
Depreciation of Improvements	
Structures (20 yrs.)	550
Roads (10 yrs.)	5,040
Interest, Land, & Improvements, 10%	22,100
Labor & Fringe except for Equipment	
Foreman	30,000
Gateman & 2 Laborers	54,000
Site Maintenance	
Roads @ 8% of Capital	4,030
Structures @ 2% of Capital	220
Utilities & Water	2,000
Taxes, Property, & Income	64,850
Miscellaneous	10,000±
Credit for Equipment Trade-In	-29,110
Total Annual Operating Cost	$808,260
Cost Per Ton	$2.81

Recalling in Section 2a, page VI-6, the collection costs, a disposal charge of $2.56 per ton was added to the cost of collection with the understanding that it was to be a credit for the disposal operation. If the operating cost per ton for this example is $2.81, then the net cost is $0.25 per ton ($2.81 - $2.56).

Taking another case to explore the economy of scale, the following typical analysis would be for a 2,000 tons-per-day, 360 days-per-year operation. For 30 years of filling at this rate in a canyon landfill site, a minimum of about one square mile of land would be required. Considering access location, a corporation yard, and other unfillable areas, a more reasonable size of site would be 1½ square miles.

Capital Costs

Land, 960 acres @ $400/acre	$384,000
Transaction @ 10%	38,400
Permanent Improvements	
Roads, 5,300' @ $14/l.f.	74,200
Utilities, Electric, 5,300' @ $3.50/l.f.	18,600
Structure, 1,500 s.f. @ $11/s.f.	16,500
Applications & EIR	20,000
Equipment	
4 - 30 ton Crawler-Dozers	586,800
3 - 32 ton Landfill Compactors	378,600
1 - 21 cu. yd. Dual Power Scraper	241,800
2 - 5,000 gal. Water Trucks	100,000
Total Capital Cost	$1,859,900

Annual Operating Costs

Equipment	
Ownership	$469,960
Operation (not always full-time)	646,470
Depreciation of Improvements	
Structures (20 yrs.)	830
Roads (10 yrs.)	7,420
Interest, Land, & Improvements, 10%	55,170
Labor & Fringe except for Equipment	
Foreman	30,000
Gateman & 2 laborers	54,000
Site Maintenance	
Roads @ 8% of Capital	5,940
Structures @ 2% of Capital	330
Utilities & Water	2,200
Taxes, Property & Income	77,900
Miscellaneous	10,000±
Credit for Equipment Trade-In	-65,400
Total Annual Operating Cost	$1,294,820
Cost Per Ton	$1.80
Disposal Charge Credit	-$2.56
Net Operating Cost Per Ton	-$0.76

Table VI-5

Summary of Unit Capital & Operating Cost Estimates, Alameda County, 1974-1975

System Component	Estimated Capital Cost ($/Ton Daily Capacity)	Estimated Operating Cost ($/Ton)
Collection	$3,000 - $4,200	$28 - $45[2]
Transfer	$1,000 - $2,000	$1 - $4
Material Recovery	$1,500 - $4,000	$-4 - $3
Energy Recovery	$20,000 -$30,000	$3 - $11[2]
Long Haul	$150 - $2,400	$3 - $4
Disposal	$1,000 - $1,500[1]	$2 - $3[2]

[1]Landfill does not have a thru-put as other system components do but rather works as a repository of given capacity. The capital required for landfill relates to both the daily capacity and the expected life of the site. The range of unit capital costs given reflect typical circumstances but may not hold true for all circumstances for the reason given.

[2]Any disposal charge is excluded from collection, energy recovery, and disposal operating costs.

3. Revenue Information:

Collection of refuse in Alameda County is an exclusive privilege; there are no overlapping territories and there is no direct competition between collection companies. The rates that the collection companies may charge for services are set by publicly elected bodies. Collection is managed under a system of ordinances and franchise contracts since, in each case, the responsibility for provision of an essential public service rests with the jurisdiction. The following does not apply to the two publicly owned and operated systems in Berkeley and San Leandro.

A local government is responsible for providing refuse collection for its citizens either by undertaking the task itself or by contracting for the service, as most do in Alameda County. At the request of the collection contractor, the contract is made exclusive so that no other collector may operate in the franchise area. Two essential rates are normally set in the franchise contract: collection service rates and the franchise return rate. Collection service rates are the charges to the customer for collecting and disposing of the customer's refuse. Naturally, there are a variety of alternative containers, frequencies and charges. The franchise return rate is a percentage of the amount the collector receives in collection charges which is reutrned by the jurisdiction. The average franchise return rate to the jurisdiction in the fourteen franchise areas of Alameda County is 6.8 percent with a range of 2 to 10 percent. The monies are deposited in the general fund.

Because the exact amount of the collection company's gross receipts from collection charges is not public information,[1] another means of acquiring this vital data is needed. The local government's share, which is public information, when divided by the franchise rate, will give the estimated gross receipts:

$$\frac{\text{Local Government Share}}{\text{Franchise Rate}} = \begin{array}{l}\text{Gross Receipts}\\ \text{from Collection}\end{array}$$

In this way, the estimated gross receipts of the collector may be found for each franchise area. The gross receipts in the two municipal systems and in Pleasanton were available from public records.

Table VI-6
Estimation of Annual Gross Receipts For Collection Service by Franchise Area: Alameda County, 1973

	Franchise Area	1973 Population	Franchise Fee Return To City ($)	Franchise Return Rate (%)	Estimated Annual Gross Receipts ($)
	Alameda County	1,147,000	$1,309,400	--	$21,670,700
Oakland Scavenger Company	Albany	15,600	16,900	7½%	225,000
	Castro Valley S. D.	41,300	69,700	10	697,400
	Emeryville	3,150	1,000	5½	218,000
	Fremont	124,000	201,600	10	2,015,600
	Hayward	97,300	193,500	10	1,935,300
	Livermore	48,800	13,100	2	654,400
	Newark	30,300	47,200	10	471,900
	Oakland	362,000	500,000	5½	9,090,900
	Oro Loma S. D.	100,000	154,300	10	1,542,500
	Piedmont	10,900	8,700	5½	158,000
	Union City	26,800	39,300	10	392,600
	Valley Com. S. D.	16,900	22,000	5	440,000
Muni-cipal	Berkeley	114,000	--	--	1,874,400
	San Leandro	46,600	--	--	490,700
Other Private	Alameda	76,100	35,600	See Note	1,005,900
	Pleasanton	31,400	6,600	$1 per acct.	458,100

Note: Franchise return rate in City of Alameda is 1½% of first $420,000 in gross receipts and 5% of all thereafter.

[1] Only the contractor and certain representatives of the franchise area, including administrators and elected officials, have access to this informantion.

The source of the gross receipts is the collection service customer in all cases. While the two municipal systems operate on funds budgeted to them through their city councils, both attempt to adjust collection service rates to exactly offset the budgeted amount. Gross receipts are expended to cover operating costs and profit or surplus in the general fund in the cases of the two municipal systems. In the Oakland Scavenger family of franchises, it is possible that the gross receipts from a few of the franchises are not sufficient to offset the costs of operation in those franchises; the difference could be made up from some of the more profitable franchises.

4. Estimated Costs of Alternative Systems:

Costs for each component of the system presented above may now be combined into the various alternatives discussed previously. The technical alternatives proposed by the Alameda County Solid Waste Management Plan Technical Advisory Committee encompass a series of changes which may be made in the present waste management operations over time to accomplish resource and/or energy recovery in compliance with SB-5. Costs are assigned to the system component based upon the estimates made above; these estimates are meaningful in the planning context and generally relate to the overall component cost or total system cost for the particular alternative. Inaccuracies which occur may be attributed to the effect of inflation over the last 15-month period as well as with the problem of obtaining accurate information from local sources and from manufacturers of equipment.

One of the basic assumptions made in this presentation is that system costs are uniform throughout the County, as estimated in previous pages of this section. In reality, they may not be equal from community to community. However, this study revealed that information of this sort has not been developed, is not now available, or not willingly released by franchise operators. In case of municipal operations, the information is not usually separated from several other departments or budget units. Finally, the County-wide context of this planning process would be defeated by a case-by-case estimate of questionable validity. It is suggested, however, that a case-by-case study of this type be undertaken as part of the plan implementation.

The existing system has a minimum of facilities and labor and provides the lowest cost of solid waste handling at an estimated $39.78 per ton. Thus, in the tables which follow, any system which provides benefits to its users, either in the form of dollars or energy savings or perhaps some other incommensurable (i.e., aesthetics) near this dollar cost ($39.78), would be highly feasible for implementation. Within this context, we see emerging the criteria for selection of systems or components of systems based upon such items as cost, level of technology, satisfaction of local needs, satisfaction of the requirements of SB-5, provision of measurable benefits (dollars, resources, energy, etc.), and the provision of immeasurable benefits such as a clean environment, system accountability.

The three short-term alternatives, 1980-A, 1980-B, and 1980-C show the effects on costs of alternative methods of handling solid wastes. Systems 1980-A and 1980-C are basically materials and energy recovery systems; 1980-A incorporates the Bay Delta composting system for a portion of Berkeley's waste. County-wide, these two systems compare quite closely with one another in both capital and operating costs; both these material and energy recovery systems require about 4½ times the capital of the existing 1975 system and operate for 4 to 5 percent more than present costs. The Bay Delta system is more expensive than the other competing systems and would cost 13 percent more to operate than the existing 1975 system. Both of these material and energy recovery systems for 1980 would meet the State goals of 25 percent resource recovery.

System 1980-B is similar to the above systems (1980-A and 1980-C) except that it does not include an energy recovery component; 1980-B is basically a materials recovery only system. Without an energy recovery system, the materials recovery only system must process large volumes of waste in its later stages, long haul transportation and disposal, and consequently the costs for these two stages are much greater than if the energy recovery component were included. A materials recovery only system will have an initial capital cost lower than if energy recovery were included, but an operating cost above that of the systems including energy recovery stages (8 percent above the existing 1975 system). The materials recovery only system would only attain 7 percent recovery and not meet the State goal of 25 percent resource recovery.

Recognizing that some beneficial use of the large paper and organic fraction of the solid waste is the key to resource recovery, all four alternatives selected for 1990 include combinations of composting and/or energy recovery.

The full scale Bay Delta system shown in Alternative 1990-A might be implemented if the demonstration project proves successful. The cost of this alternative appears uniformly high in comparison to the other 1990 options. Another variation of 1990-A shows combined energy recovery and composting modules which may prove to be a quite viable alternate.

Alternatives 1990-B, 1990-C, and 1990-D are three applications of the basic materials and energy recovery system, differing only in the planning units that are covered by the system. To generalize on the cost changes in these three alternatives, the planning units which receive only conventional collection-disposal service will cost about 5 or 6 percent less per ton than the planning units receiving service through a full resource recovery system. As would be expected, the alternatives which recover more resources are slightly more costly to operate.

Table VI-7

Summary of Cost Estimates of Alternative Solid Waste Management Systems: Alameda County, 1975, 1980, and 1990.

System	Total Capital Cost	New Capital Required[1]	Annual Operation Cost	Average Cost Per Ton[2]
1975 (Existing)	$ 18.8 M	$ 0.0 M	$43.1 M	$39.78
1980 - A	84.4 M	65.6 M	49.7 M	41.73
1980 - B	36.2 M	17.4 M	51.3 M	43.05
1980 - C	86.7 M	67.9 M	49.3 M	41.42
1990 - A	49.7 M	30.9 M	68.8 M	47.57
1990 - B	99.9 M	81.1 M	59.8 M	41.37
1990 - C	123.7 M	115.9 M	61.2 M	42.35
1990 - D	121.8 M	103.0 M	60.2 M	41.93

[1] Total capital less $18.8 million in the existing system assumed to continue in service.

[2] Costs include depreciation on capital investment.

Figure VI-2

ESTIMATED ANNUAL OPERATING COSTS: 1975 EXISTING SYSTEM, CAPITAL COST $18.8M
(1974 Dollars, M = Million)

CITIES & PLACES	PLANNING UNITS	GENERATION/ COLLECTION $37.23/TON	TRANSFER $1.44/TON	MATERIALS RECOVERY $0.13/TON	ENERGY RECOVERY $3.00/TON	LONG HAUL TRANSPORTATION $3.50/TON	DISPOSAL $2.50/TON	TOTAL BY PLACE	COST PER TON ($)
Berkeley	CMPU	$3.96M					$0.27M	$4.23M	$39.78
Alameda	CMPU	$2.76M						$2.95M	$39.78
Albany Emeryville Oakland Piedmont	CMPU	$13.58M					$1.76M	$14.49M	$39.78
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	$9.89M						$10.55M	$39.78
Dublin/San Ramon Livermore	LAVPU[2]	$2.48M					$0.24M	$2.64M	$39.78
Pleasanton	LAVPU[2]	$1.13M						$1.21M	$39.78
Fremont Newark Union City	WPU	$6.59M					$0.44M	$7.03M	$39.78
County Total 2		$40.39					$2.71M	$43.10M	$39.78

[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure VI-3

ESTIMATED ANNUAL OPERATING COSTS: ALTERNATIVE 1980-A, CAPITAL COST $84.4M
(1974 Dollars, M = Million)

CITIES & PLACES	PLANNING UNITS	GENERATION/ COLLECTION $37.28/TON	TRANSFER $1.44/TON	MATERIALS RECOVERY $0.13/TON	ENERGY RECOVERY $3.00/TON	LONG HAUL TRANSPORTATION $3.50/TON	DISPOSAL $2.50/TON	TOTAL BY PLACE	COST PER TON ($)
Berkeley	CMPU	$4.16M	$0.07M	--		$0.22M[3]	$0.20M[4]	$5.04M	$45.21
Alameda		$3.10M						$3.49M	$42.04
Albany Emeryville Oakland Piedmont		$14.41M	$0.78M	$0.11M	$2.24M	$0.24M	$0.17M	$16.25M	$42.04
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	$10.79M	$0.42M					$12.17M	$42.04
Dublin/San Ramon Livermore	LAVPU[2]	$3.03M					$0.30M	$3.24M	$39.78
Pleasanton		$1.39M						$1.48M	$39.78
Fremont Newark Union City	WPU	$7.51M					$0.50M	$8.01M	$39.78
County Total 2		$44.39M	$1.27M	$0.11M	$2.24M	$0.46M	$1.17M	$49.68M	$41.73

1 A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
2 A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.
3 Barge transport to Delta Computed at $10.50 per ton.
4 Placement of compost computed at $9.50 per ton.

Figure VI-4

ESTIMATED ANNUAL OPERATING COSTS: ALTERNATIVE 1980-B, CAPITAL COST $36.2M
(1974 Dollars, M = Million)

CITIES & PLACES	PLANNING UNITS	GENERATION/ COLLECTION $37.28/TON	TRANSFER $1.44/TON	MATERIALS RECOVERY $0.13/TON	ENERGY RECOVERY $3.00/TON	LONG HAUL TRANSPORTATION $3.50/TON	DISPOSAL $2.50/TON	TOTAL BY PLACE	COST PER TON ($)
Berkeley	CMPU	$4.16M	$0.16M					$4.93M	$44.26
Alameda	CMPU	$3.10M						$3.68M	$44.26
Albany Emeryville Oakland Piedmont	CMPU	$14.41M	$0.68M	$0.11M		$2.74M	$1.96M	$17.11M	$44.26
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	$10.79	$0.4M					$12.81M	$44.26
Dublin/San Ramon Livermore	LAVPU[2]	$3.03M					$0.30M	$3.24M	$39.78
Pleasanton	LAVPU[2]	$1.39M						$1.48M	$39.78
Fremont Newark Union City	WPU	$7.51M					$0.50M	$8.01M	$39.78
County Total 2		$44.39M	$1.25M	$0.11M		$2.74M	$2.76M	$51.26M	$43.05

[1]A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2]A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure VI-5

ESTIMATED ANNUAL OPERATING COSTS: ALTERNATIVE 1980-C, CAPITAL COST $86.7M
(1974 Dollars, M = Million)

CITIES & PLACES	PLANNING UNITS	GENERATION/ COLLECTION $37.28/TON	TRANSFER $1.44/TON	MATERIALS RECOVERY $0.13/TON	ENERGY RECOVERY $3.00/TON	LONG HAUL TRANSPORTATION $3.50/TON	DISPOSAL $2.50/TON	TOTAL BY PLACE	COST PER TON ($)
Berkeley	CMPU	$4.16M	$0.16M					$4.68M	$42.03
Alameda		$3.10M						$3.49M	$42.03
Albany Emeryville Oakland Piedmont		$14.41M	$0.68M	$0.11M	$2.35M	$0.25M	$0.18M	$16.25M	$42.03
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	$10.79M	$0.42M					$12.17M	$42.03
Dublin/San Ramon Livermore	LAVPU[2]	$3.03M					$0.30M	$3.24M	$39.78
Pleasanton		$1.39M						$1.48M	$39.78
Fremont Newark Union City	WPU	$7.51					$0.50M	$8.01M	$39.78
County Total 2		$44.39M	$1.25M	$0.11M	$2.35M	$0.25M	$0.98M	$44.32M	$41.42

[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure VI-6

ESTIMATED ANNUAL OPERATING COSTS: ALTERNATIVE 1990-A, CAPITAL COST $49.7M
(1974 Dollars, M = Million)

CITIES & PLACES	PLANNING UNITS	GENERATION/ COLLECTION $37.23/TON	TRANSFER $1.44/TON	MATERIALS RECOVERY $0.13/TON	ENERGY RECOVERY $3.00/TON	LONG HAUL TRANSPORTATION $3.50/TON	DISPOSAL $2.50/TON	TOTAL BY PLACE	COST PER TON ($)
Berkeley		$4.59M	$0.18M					$5.86M	$47.57
Alameda		$3.65M						$4.65M	$47.57
Albany Emeryville Oakland Piedmont	CMPU	$15.97M	$0.76M	$0.08M		$4.60M[3]	$4.16M[4]	$20.37M	$47.57
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	$12.57M	$0.49M					$16.03M	$47.57
Dublin/San Ramon Livermore	LAVPU[2]	$4.37M	$0.25M	$0.10M		$2.23M	$1.59M	$5.57M	$47.57
Pleasanton		$2.00M						$2.56	$47.57
Fremont Newark Union City	WPU	$10.76M	$0.42M					$13.73M	$47.57
County Total 2		$53.91M	$2.10M	$0.18M		$6.83M	$5.75M	$68.77M	$47.57

[1]A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2]A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.
[3]Barge transport to Delta computed at $10.50 per ton.
[4]Placement of compost computed at $9.50 per ton.

Figure VI-7

ESTIMATED ANNUAL OPERATING COSTS: ALTERNATIVE 1990-B, CAPITAL COST $99.9M
(1974 Dollars, M = Million)

CITIES & PLACES	PLANNING UNITS	GENERATION/ COLLECTION $37.28/TON	TRANSFER $1.44/TON	MATERIALS RECOVERY $0.13/TON	ENERGY RECOVERY $3.00/TON	LONG HAUL TRANSPORTATION $3.50/TON	DISPOSAL $2.50/TON	TOTAL BY PLACE	COST PER TON ($)
Berkeley	CMPU	$4.59M	$0.18M					$5.17M	$42.05
Alameda		$3.65M						$4.11M	$42.05
Albany Emeryville Oakland Piedmont		$15.97M	$0.76M	$0.13M	$2.66M	$0.28M	$0.20M	$18.02M	$42.05
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	$12.57M	$0.49M					$14.18M	$42.05
Dublin/San Ramon Livermore	LAVPU[2]	$4.37M $2.00M					$0.43M	$4.66M	$39.78
Pleasanton								$2.14M	$39.78
Fremont Newark Union City	WPU	$10.76M					$0.72M	$11.53M	$39.78
County Total 2		$53.91M	$1.43M	$0.13M	$2.66M	$0.28M	$1.35M	$59.81M	$41.37

[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure VI-8

ESTIMATED ANNUAL OPERATING COSTS: ALTERNATIVE 1990-C, CAPITAL COST $123.7M
(1974 Dollars, M = Million)

CITIES & PLACES	PLANNING UNITS	GENERATION/ COLLECTION $37.28/TON	TRANSFER $1.44/TON	MATERIALS RECOVERY $0.13/TON	ENERGY RECOVERY $3.00/TON	LONG HAUL TRANSPORTATION $3.50/TON	DISPOSAL $2.50/TON	TOTAL BY PLACE	COST PER TON ($)
Berkeley	CMPU	$4.59M	$0.18M	$0.08M	$1.95M	$0.18M		$5.22M	$42.35
Alameda		$3.65M	$0.76M					$4.14M	$42.35
Albany Emeryville Oakland Piedmont		$15.97M						$18.14M	$42.35
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	$12.57M	$0.49M	$0.10M	$2.39M	$0.23M	$0.29M	$14.28M	$42.35
Dublin/San Ramon Livermore	LAVPU[2]	$4.37M	$0.25M					$4.96M	$42.35
Pleasanton		$2.00M						$2.27M	$42.35
Fremont Newark Union City	WPU	$10.76M	$0.42M					$12.22M	$42.35
County Total 2		$53.91M	$2.10M	$0.18M	$4.34M	$0.41M	$0.29M	$61.23M	$42.35

[1]A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2]A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

Figure VI-9

ESTIMATED ANNUAL OPERATING COSTS: ALTERNATIVE 1990-D, CAPITAL COST $121.8M
(1974 Dollars, M = Million)

CITIES & PLACES	PLANNING UNITS	GENERATION/ COLLECTION $37.28/TON	TRANSFER $1.44/TON	MATERIALS RECOVERY $0.13/TON	ENERGY RECOVERY $3.00/TON	LONG HAUL TRANSPORTATION $3.50/TON	DISPOSAL $2.50/TON	TOTAL BY PLACE	COST PER TON ($)
Berkeley	CMPU	$4.59M	$0.18	$0.08M		$0.18M		$5.20M	$42.21
Alameda		$3.65M	$0.76M		$1.95M			$4.13M	$42.21
Albany Emeryville Oakland Piedmont		$15.97M						$18.08M	$42.21
Castro Valley Hayward San Leandro[1] San Lorenzo	EPU	$12.57M	$0.49M				$0.26M	$14.23M	$42.21
Dublin/San Ramon Livermore	LAVPU[2]	$4.37M		$0.08M	$1.69M	$0.18M	$0.43M	$4.66M	$39.78
Pleasanton		$2.00M						$2.14M	$39.78
Fremont Newark Union City	WPU	$10.76M	$0.42M					$12.18M	$39.78
County Total 2		$53.91M	$1.85M	$0.16M	$3.64	$0.36M	$0.69M	$60.62M	$41.93

[1] A portion of San Leandro's solid waste is handled through the CMPU collection system - see population assumptions for explanation.
[2] A portion of San Ramon is included in the LAVPU data - see population assumptions for explanation.

B. Economic Considerations of Recovering Resources from Municipal Solid Wastes

1. Factors Affecting the Flow of Secondary Materials to Markets.

a. Introduction

Resource recovery from solid wastes has the potential to aid in solving two major problems: 1) Difficulty in disposing of solid wastes and 2) Declining inventory of natural resources. Resource recovery reduces the amount of solid wastes that must be disposed and provides an alternative source of raw materials for production so that virgin natural resources need not be exploited as quickly.

b. The Salvage Industry

Resource recovery is not a new concept. The salvage industry has traditionally worked with most industries to process and recycle materials that would otherwise become waste. Recently (since 1970), smaller citizen recycling centers have started and accomplish the same type of resource recovery. The following table[1] shows that the salvage industry in 1967-68 recycled about 25% of the total production for that year.

Material	Total Consumption (million tons)	Total Recycled (million tons)	Recycling as Percent of Consumption
Paper	53.110	10.124	19.0
Iron & steel	105.900	33.100	31.2
Aluminum	4.009	.733	18.3
Copper	2.913	1.447	49.7
Lead	1.261	.625	49.6
Zinc	1.592	.201	12.6
Glass	12.820	.600	4.2
Textiles	5.672	.246	4.3
Rubber	3.943	1.032	26.2
Total	191.220	48.108	25.2

Recycling, as percent of total consumption, has been declining for 30 years in spite of the fact that tonnage recycled has increased. This is, of course, because of greatly increased production/consumption over the last 30 years. The activity of the salvage industry does not have a direct bearing upon recycling solid wastes because these are presently two different material flows. The point is that some of the machinery, organizations, and expertise for handling secondary materials already exists.

[1] Salvage Markets for the Materials in Solid Wastes, EPA, page xvii

c. Demand

Any system of resource recovery, including the existing system, must be tailored to the demand for the recovered materials. Materials will be recovered from waste if an individual or manufacturer wants them; i.e., if they are less expensive than other comparable alternatives. As the nation's landfills continue to build up with "waste," it is clear that the supply of such materials far exceeds the demand for them. A material is called a "waste" if there is no demand for it and called a "secondary material" if there is a demand.

The question arises then why is demand for the materials in municipal solid waste so low? A part of the problem falls in the area of public acceptance. Americans, being an affluent people, have not wanted to "dirty their hands" with waste products. Poorer families often reduce the amount of solid waste by purchasing second hand items such as clothing from social welfare agencies such as Goodwill or Salvation Army. The public, as a whole, appears to feel that a product is tainted if it is a secondary use of materials (made from waste). In fact, many products made from secondary materials can be at least qualitatively equal to the product made from the virgin material. Most of the general public's skepticism of products made from "waste" is unjustified.

d. Factors in the Cost of Secondary Materials

The second, and primary, reason why demand for solid waste materials is low is that they frequently cost more as a "raw" material than the corresponding virgin material. The relatively higher cost of secondary materials in comparison to virgin materials or alternate materials is due to:

1) Contamination of the material with other materials or impurities and the associated cost of decontamination/separation;

2) Quality control of the secondary material - often manufacturers cannot identify a material (such as a certain aluminum alloy) and thus cannot have confidence in exactly what the input raw material to their system actually is;

3) Transportation costs often are prohibitively high or prejudiced against secondary material;

4) Tax burden in comparison to virgin materials;

5) The capital investment and historical inertia of virgin material extraction which must be amortized; and

6) Cost accounting systems normally used that do not measure all costs, frequently neglecting the "externalities" such as pollution which is then accounted for in government spending.

Contamination/Separation: Secondary materials become contaminated in two ways: 1) by being physically or chemically attached to another material or waste in production, and 2) by being collected and stored with other materials or waste after consumption. For example, the bi-metalic soft drink container is made from sheet aluminum and sheet tin-coated steel. The tin is chemically bonded to the sheet steel in a very thin layer and this subassembly is then physically crimped to an aluminum top. All three of these materials (tin, steel and aluminum) have relatively high values if they are separated from each other - tin, about $3,000-$4,000 per ton, sheet steel, about $25 per ton, and aluminum about $300 per ton. Taken together as a bi-metalic can, the value is about $20 per ton, less than the least valuable of its constituents. While the above is an example of production contamination, the same container may then be thrown in with all the other solid wastes at disposal time, and be further contaminated. Most kinds of production can accommodate small levels of contamination but nothing on the order of that found in solid wastes.

The technology exists to mechanically separate solid waste into ferrous metals, nonferrous metals, clear, green and amber glass, but to date the cost of such separation is too high to be financially attractive. The infinate variety of plastics are virtually inseparable, and virtually unusable when combined; likewise with most paper. The separation of solid wastes into like materials is a cost that must be absorbed by each material as it becomes a raw input to production; more valuable (rarer) materials, such as tin, are usually better able to absorb all costs including separation.

Transportation: The position held by the associations of secondary materials dealers, namely, the Institute of Scrap Iron and Steel and the National Association of Secondary Materials Industries, Inc., is that transportation costs discriminate against recycled materials. They believe that secondary materials could compete effectively with virgin materials if this and other types of discrimination did not exist.

The system of determining shipping charges begins with the carrier who lists his costs and profit required to ship a specific amount of a specific item from Point A to Point B. The carrier's proposed charge must then be approved by the Interstate Commerce Commission. Following are the main factors that go into determining the carrier's costs:

1) Distance from A to B. The carrier may not always travel by the shortest route because of topography, weather, other cargo, etc.;

2) Maintenance of equipment, which can vary with terrain crossed, weather conditions and other factors, is especially important in the case of railroads;

3) Weight of commodity shipped. This probably has a negligible impact on maintenance;

4) Volume of commodity shipped. Less dense commodities will usually cost more when measured on a per weight basis than denser, heavier items because of the railroad's natural ability to carry heavy items;

5) Type of commodity shipped. The important factor here is the potential for damage to the commodity in shipment. Generally, higher value items are charged more than cheaper or indestructible items.

Because virgin and secondary materials do not take the same form, weight, density, value, transportation route, or distance, it becomes necessary to determine their transportation charges at different rates. Generally speaking, virgin materials tend to come from a point source and are delivered to a point destination. On the other hand, secondary materials originate in a variety of sources for delivery to the point destination. This diversity of origination points for secondary materials is reflected in higher transportation costs. Materials will usually travel by truck for distances less than 500 miles and by rail for greater distances.

Taxation: In the competition between virgin and secondary raw materials for production, the treatment of these materials under tax laws is an important factor. The cost of taxation must eventually be reflected in the sale price of the finished product to the consumer. Although each raw material is a unique case, the raw materials which go into paper and textiles are categorically different.

Income from sale of textiles made from natural fibers such as cotton and wool is taxed identically whether the textiles are made from virgin natural fibers or recycled natural fibers. With respect to taxation, virgin and secondary raw materials compete equally in production of textiles made from natural fibers. Increasingly, textiles are being made from synthetic fibers and in this case, taxation is different for virgin and recycled textiles. Petroleum extracted for production of synthetic fibers is subject to a depletion allowance which reduces the taxable gross income of the company. Indirectly, this tax saving is reflected in the cost of the finished product. On the other hand, textiles made from recycled synthetic fibers enjoy no similar tax deduction.

The basic raw materials to produce new paper are either virgin wood pulp (timber) or recycled paper or a combination thereof. If the paper is made from virgin timber, a cost depletion allowance may be deducted from taxable income; if made from recycled paper, no deduction is allowed. Timber extration enjoys another tax advantage not available to extraction of other virgin materials or to use of recycled materials. Income from timber extraction is taxed as capital gains or at a rate equal to half of the rate for ordinary income. This further tax savings for the virgin wood pulp raw material is competitively disadvantageous to the recycled paper raw material.

Discrimination in taxation of income from sale of all other raw materials (virgin vs. secondary) can be explained categorically. Extraction of the virgin material allows the producer to enjoy the more beneficial tax treatment of either cost or percentage depletion while extraction of the secondary material provides no special tax treatment. Incidently, California State tax law on depletion and capital gains is exactly the same as Federal law.

Timber extraction is subject to cost depletion only while extraction of all other virgin resources is subject to either cost or percentage depletion, whichever is more advantageous to the taxpayer. Cost depletion is a method of amortizing and deducting the original cost of the timber rights (not the land) over the useful life of those rights. Percentage depletion is a method of excluding from taxable income a certain percentage of the income from sales

of the virgin material. The depletion percentages range from 5% for gravel and certain clays to 22% for sulphur, uranium, oil and gas and certain other minerals.[1] Cost depletion, because it is based on the original cost at time of purchase, is very dependent on the original appraisal of the value of the resource and on inflationary economic changes in the value of money. Percentage depletion is more flexible, less speculative and provides a deduction in proportion to production rather than in proportion to the original speculative investment.

Capital Commitment and Inertia: The United States is and has always been endowed with abundant natural resources. Historically, national policy has been to exploit those resources. A large amount of capital outlay is committed to this policy of resource extraction in the form of both land and improvements. At a given level of production, every ton of secondary raw material will mean one less ton of virgin raw material input. Consequently, the capital expenses of virgin material extraction will not be amortized as quickly (or at all). At the same time, new capital would be needed to extract and separate materials from solid wastes. Hence, the course that we have followed in the past is a powerful factor in making a continuation of that course the easiest (cheapest) to follow in the future. Because extraction of virgin materials is inherently more costly than recovery of secondary materials, a larger amount of extraction capital would be idled for every dollar of recovery capital invested; in other words, there are two capital costs that are incurred in switching from extraction to recovery, and the larger cost is an indirect cost. Normal methods of amortizing capital expenditures will tend to temper the change-over process.

Cost Accounting Systems: The following paragraphs explain the reason why cost accounting can lead to priorities which favor virgin materials over recycled materials.

The Problem of Comprehensive Economic Accounting.[2] When is it "cheaper" to use secondary materials? The answer would be easy to give if the total costs, tangible and intangible, costs of producing, distributing, using, and disposing of materials were known.

Today, financial accounting practices, industrial reporting practices and census survey practices do not permit the tracing of a material all the way from a mine to the terminal disposal point, showing at each step in the process, the energy consumed and the energy effluents produced, the water consumed and the quality of the liquid effluent, the solid waste generated, the manpower inputs required, and the like - both in production and transportation steps. These are measurable external cost elements but they are not available today.

[1] The Federal Income Tax, Clarence McCarthy, Prentice Hall 1971.

[2] Source: Salvage Markets for Materials in Solid Wastes, Midwest Research Institute for the EPA, 1972, page 90.

Such data are not readily available because they were not heretofore needed. Meaningful environmental analysis, however, requires data on the total environmental impact of a product or material.

To compare the solid waste generation associated with a steel can, for instance, versus a glass bottle, it is not enough to know what each one weighs and how much space each occupies. One also needs to know the quantity of mine tailings generated in mining raw materials, unusable residues generated in raw materials conversion, quantities of unsalable fabrication wastes generated, and the like. Solid waste generation is only one of the many dimensions of external costs.

2. Economic Considerations of Recovering Resources from Municipal Solid Wastes

a. Introduction

As local jurisdictions contemplate methods to carry out the mandate of SB-5, i.e. maximum feasible resource recovery, the economic impact of redirecting the resources back into the economy should be fully considered. Resource recovery from solid waste can be divided into two headings: materials recovery and energy recovery. This report emphasizes economic impacts of materials recovery because the impact of energy recovery upon existing markets is not nearly as potentially problematical. An analysis of the issues relating to each of the materials which are likely to be recoverable from the solid waste stream will be presented along with possible methods of integrating them into the economy with minimum disruption of existing institutions.

b. Energy Recovery

The critical aspect of energy recovery from solid waste is what form or state the energy will take. The possible systems for energy recovery (described in detail in the Alternatives Report) have capabilities to produce energy in three different forms or states: steam, electricity, gas or oil. Municipal solid waste has an energy content of 5,000 BTU per pound. In terms of efficiency these three types of energy would be ranked as follows:

1. Steam
2. Electricity
3. Gas or oil

In other words, the greatest amount of energy would be recovered per input ton of municipal solid waste if the steam-producing alternative were selected. However, the greatest efficiency does not necessarily lead to the greatest value for either the seller or the buyer of the energy.

The characteristics of both steam and electrical energy are such that these forms of energy must be used when they are produced, they cannot be stored.[1] Steam is further limited by the fact that it cannot be transmitted very far, perhaps several hundred feet from its point of origin. Indirectly, it is possible to think of electricity as "storable" because of the existing methods of electrical generation in California. About 27% of California's electrical generation comes from hydro power and the remainder from various fuels, mostly oil.[2]

If a portion of the load at a given time were to be taken up by an energy recovery facility, the fuel-fired plants would use less fuel to compensate. Thus, the electrical energy recovered from solid waste is indirectly through the system translated into an oil surplus (at some other location), and consequently can be stored. Needless to say, oil or gas recovered directly from the solid waste has no unique storage or handling characteristics.

The basic reason why the energy recovery issue is not a difficult marketing problem, when compared to the materials recovery problem, is because demand for energy is expanding. Furthermore, it appears that the demand for energy is ever-increasing. Under these conditions of high demand and rising prices, users of energy will still seek it in its most economical form. Energy in the form of steam, although most efficient, would be useful to only a very few nearby users. The steam energy recovery system would be so small a system that shutdowns, breakdowns, strikes, or other types of disruption in either supply or demand for the energy would have crippling effects on everyone in the system. For these reasons the direct recovery of steam from municipal solid waste does not appear to be the best alternative.

Energy recovered in the form of either electricity or gas and oil will always have a buyer. These forms of energy are storable and their markets can thus survive disruptions in either supply or demand. Electricity and gas can be integrated into the vast utility system so as to distribute their economic impact. The recovery of oil is relatively less desirable because it is not generally used for heating on the West Coast and transportation costs are thus implicit in its use.

c. Materials Recovery

Municipal solid waste is composed of paper, metals, glass and other organic matter. In terms of recovery and marketing of these materials, each is a unique case because of differences in existing demand or supply, value, existing processing plants, and material contamination among other reasons. Each material requires independent analysis to determine the best way to effect its recovery.

The composition of municipal solid wastes varies slightly depending upon its origin, but this variation is not significant to the purpose of this report. Research undertaken by the National Center for Resource Recovery has resulted in estimates of municipal solid waste composition by weight. Although several studies have developed similar breakdowns, the following data in Table VI-8, prepared for Contra Costa County, seems to be the most reasonable and useful with respect to the other studies done on composition.

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[1]To be precise, some electricity can be stored by pump-storage at a reservoir, but this technique is used to cope with diurnal load (demand) variations and is too inefficient to be a good basis for design.

[2]1972, Statistical Abstract, U. S. Census, Table No. 834.

Approximate Composition of Municipal Solid Waste

Table VI-8

Material		Percent by Weight
Paper and Paperboard		
Corrugated	22	
Newspaper	9	
Other	12	
Total		43
Ferrous Metal		
Cans	5	
Other	3	
Total		8
Aluminum and Other Non-Ferrous Metal		1
Glass and Ceramics		10
Garbage and Yard Waste		33
Miscellaneous:		
Plastics, textiles, rubber, etc.		5
Total		100

Sources:

National Center for Resource Recovery, Bulletin, Vol. III, No. 2, Spring, 1973.

"Cleaning Our Environment", report by the American Chemical Society, 1969, p. 165.

"Solid Waste Management; a Comprehensive Assessment of Solid Waste Problems, Practices and Needs", Office of Science and Technology, 1969, U.S.

"Comprehensive Studies of Solid Waste Management", First and Second Annual Reports, Sanitary Engineering Research Lab, Univ. of Calif., 1970, U.S. Public Health Service Report SW 3rg.

SOURCE: The Citizens Advisory Committee on Solid Waste Recycling: Final Report & Recommendations, January 1974, Central Contra Costa Sanitary District, page 18.

Table VI-8 applies to municipal solid waste only. Municipal solid waste comprises about one-half of the total. The remainder, mostly industrial and some agricultural solid waste, is not rich in valuable recoverable materials and, consequently, is not being considered as a source of secondary materials.

Using the NCRR composition estimates and generation tonnage figures developed for Alameda County in Part VI of the Plan, estimated generation by material is computed below in Table VI-9. Multiplying by the current unit value, $300/ton for nonferrous and $20/tons for all others, shows the approximate value of these resources that are now being deposited in landfills. Tonnage and value that is presently recycled by community recycling centers is not included in this data.

Table VI-9

ESTIMATED GENERATION OF SOLID WASTE BY RECOVERABLE MATERIAL AND GROSS VALUE IN MUNICIPAL FRACTION[1]: ALAMEDA COUNTY AND FOUR CONSTITUENT PLANNING UNITS, 1975

Planning Unit	Total Generation (Tons/Yr.)	Ferrous Metals (8%) Amount (Tons/Yr.)	Ferrous Metals (8%) Value $ Million	Nonferrous Metals (1%) Amount (Tons/Yr.)	Nonferrous Metals (1%) Value $ Million	Glass (10%) Amount (Tons/Yr.)	Glass (10%) Value $ Million	Newspaper (9%) Amount (Tons/Yr.)	Newspaper (9%) Value $ Million	Corrugated Cardboard (22%) Amount (Tons/Yr.)	Corrugated Cardboard (22%) Value $ Million	Total Recoverable (50%) Amount (Tons/Yr.)	Total Recoverable (50%) Value $ Million
CMPU	544,500	21,800	$0.44	2,720	$0.82	27,200	$0.54	24,500	$0.49	59,900	$1.20	136,100	**$3.49**
EPU	265,300	10,600	$0.21	1,330	$0.40	13,300	$0.27	11,900	$0.24	29,200	$0.58	66,300	**$1.70**
LAVPU[2]	96,800	3,900	$0.08	480	$0.14	4,800	$0.10	4,400	$0.09	10,600	$0.21	24,200	**$0.62**
WPU	176,800	7,100	$0.14	880	$0.26	8,800	$0.18	8,000	$0.16	19,400	$0.39	44,200	**$1.13**
COUNTY	1,083,400	43,300	$0.87	5,420	$1.63	54,200	$1.08	48,800	$0.98	119,200	$2.38	270,900	**$6.94**

[1]Municipal fraction is assumed to be half of the total generation.

[2]A portion of San Ramon, Contra Costa County, in included in the LAVPU data.

Scanning Table VI-9, it becomes apparent that an immense amount of potentially recoverable materials or resources are not being utilized Corrugated cardboard, a material which is itself largely made from recycled fiber, represents an annual loss of over $2.3 million. Nonferrous metals lost to landfill are of high value per tons and amount to over $1.6 million annually in spite of their small volume (about 1%). Recently, in a nationally broadcast speech, President Ford emphasized the immense value of resources thrown away by Americans and the positive impact upon the inflation problem that recovering those resources would have. Total recoverable resources lost in Alameda County along are estimated to be $6.9 million annually.

While Table VI-9 shows the resources lost through the existing solid waste stream, technological limitations prevent the full recovery of these materials. For example, existing methods of separating aluminum from municipal solid waste will only capture 70% of the metal going through the separation system. Table VI-10 presents the results of study done by the National Center for Resource Recovery on technologically feasible recovery rates.

Table VI-10

Input, Recovery Rates and Output of Municipal Solid Waste Separation Equipment.[1]

Material	Input	Recovery Rate	Marketable Output
Paper	43%	10.0%	4.3%
Ferrous	8%	94.5%	7.6%
Glass	10%	64.0%	6.4%
Aluminum	0.7%)	70.0%	0.5%)
Other	) 1%		) 0.7%
Nonferrous	0.3%)	80.0%	0.2%)
Total			19.0%

[1] Materials Recovery System, NCRR, Table 3-1, page 3-21

Note the relative recovery rates of each material, particularly paper, because this technological limitation has strong implications as to the optimum resource recovery scheme; this point will be developed later in this report, when paper is discussed individually.

Again, applying the recovery percentages to the planning unit generation figures, an estimate is made of the tonnage and value of the resource materials that could actually be recovered for marketing.

Table VI-11

ESTIMATED MAXIMUM OUTPUT AND NET VALUE OF MATERIALS SEPARABLE FROM SOLID WASTES UNDER CURRENT TECHNOLOGY: ALAMEDA COUNTY, 1975

ng	Total Generation (Tons/Yr.)	Ferrous Metals (7.6%) Amount (Tons/Yr.)	Ferrous Metals (7.6%) Value $ Million	Nonferrous Metals (0.7%) Amount (Tons/Yr.)	Nonferrous Metals (0.7%) Value $ Million	Glass (6.4%) Amount (Tons/Yr.)	Glass (6.4%) Value $ Million	Newspaper (0.9%) Amount (Tons/Yr.)	Newspaper (0.9%) Value $ Million	Corrugated Cardboard (2.2%) Amount (Tons/Yr.)	Corrugated Cardboard (2.2%) Value $ Million	Total Recoverable (17.8%) Amount (Tons/Yr.)	Total Recoverable (17.8%) Value $ Million
	544,500	20,700	$0.21	1,910	$0.57	17,400	$0.14	2,450	$0.02	5,990	$0.06	48,500	$1.00
	265,300	10,100	$0.10	930	$0.28	8,500	$0.07	1,190	$0.01	2,920	$0.03	23,600	$0.49
	96,800	3,700	$0.04	340	$0.10	3,100	$0.02	440	$0.00	1,060	$0.01	8,600	$0.17
	176,800	6,700	$0.07	620	$0.19	5,700	$0.04	800	$0.01	1,940	$0.02	15,700	$0.33
	1,083,400	41,200	$0.41	3,790	$1.14	34,700	$0.27	4,880	$0.05	11,920	$0.12	96,400	$1.99

tion of San Ramon, Contra Costa County, is included in the LAVPU data.

Significantly lower estimated unit values are used in Table VI-11 because of less pure output and possibly depressed prices due to over supply. The estimated unit values used are those developed by NCRR: Ferrous metals @ $10/ton, nonferrous metals @ $300/ton, 5/8 of the glass @ $12/ton, 3/8 of the glass @ $1/ton and paper and corrugated @ $10/ton. The 5/8 portion of the glass is of larger size and color sorted, and the remaining 3/8 is undifferentiated fines.

Materials are recycled either through "source separation" which is where the individual sorts his own garbage into cans, glass, etc. or through the "front end" machinery at a solid waste processing facility. Different types and degrees of material contamination are experienced with these two recycling methods. A precise knowledge of the degree and nature of any contamination of a raw material for input to manufacturing is essential to the manufacturer. This point bears repeating because it is an important aspect of the relationship between supply and demand for secondary materials. Within reason, the amount of contamination of a material with other foreign materials is not nearly so important as a knowledge of what and how much those contaminants are. If the contaminants can be identified, adjustments can be made in production to account for them. Responding to this need for secondary material specifications, the NCRR has developed material standards which are technologically feasible.

For the purpose of this report, these specific standards are examples only as local market and engineering considerations might suggest different specifications for Alameda County. The sample specifications are in Tables VI-12 through VI-19.

Table VI-12

Specification for Can Bundles Ferrous Scrap

Alloy Composition	Essentially similar to cold rolled steel used for can stock but containing up to 4% aluminum*
Plastics:	Visibly free except for plastics normally used in can construction
Dirt:	Less than 1%
Loose Organics:	3.0% including small amounts of paint, paper, food wastes, etc. If incinerated, this is reduced to 1.0% burned organics, char and similar residues.
Bale Size:	Maximum 2 x 2 x 5 feet
Bale Density:	75 lbs./cu. ft., nominal

*Some 31% of all cans produced are tin-free steel and approximately 92% of these are bi-metal (aluminum ends). The weight of aluminum is 11.2% of the can weight. From these data, 3.2% aluminum in the bundles is a reasonable expectation. (Source: Personal Communication, H. Alter and Continental Can Co., 1972.) The 4.0% aluminum content listed above allows for seasonal variation, such as in the summer, when it is likely there will be more bi-metal beverage cans in the refuse.

SOURCE: Materials Recovery System, National Center for Resource Recovery, December, 1972, page 5-25.

Table VI-13

QUALITY OR CHEMICAL COMPOSITION LIMITS OF ALUMINUM SCRAP FOR WROUGHT PRODUCTS

Maximum Contents[a]

Element	Grade I
Si (Silicon)	0.3[c]
Fe (Iron)	0.5
Cu (Copper)	0.25
Mn (Manganese)	1.25
Mg (Magnesium)	2.0
Cr (Chromium)	0.2
Ni (Nickel)	0.2
Zn (Zinc)	0.5
Bi (Bismuth)	0.1
Pb (Lead)	0.1
Sn (Tin)	0.1
others	0.15[d]
dirt, fines	1.0
loose organics	3.0[e]
glass	1.0
Al (Aluminum)	rem[b]

Notes: [a]Downgrading of the Grade I selling price to be in proportion to the extent of dilution with primary metal necessary to achieve the composition limits. Maximum permissible dilution will be 50%.

[b]For samples of melt loss exceeding 10%, the selling price will be further down graded in proportion to the melt loss.

[c]As alloyed.

[d]Less than 0.05 each.

[e]Not including can coatings.

SOURCE: Materials Recovery System, National Center for Resource Recovery, December, 1972, p. 5-32.

Table VI-14

Chemical Composition Limits of Al Scrap For Secondary Metal

Maximum Contents

Element	Wt.%
Si	5.0
Fe	1.0
Cu	1.0
Mn	1.25
Mg	2.0
Cr	0.3
Ni	0.3
Zn	1.0
Bi	0.3
Pb	0.3
Sn	0.3
fines	3.0
Al	rem

SOURCE: Materials Recovery System, National Center for Resource Recovery, December, 1972, p. 5-34.

Table VI-15

Specifications for Other,
Excluding Aluminum, Non-ferrous Metals

Material:	Mixed non-ferrous metal
Description:	Predominantly copper bearing alloys, pieces -2", +1/16"
Packing:	Loose, 12-20 lbs./cu.ft.
Prohibitive Materials:	1/2% organics 3% dirt, glass
Outthrows:	Aluminum pieces, magnetic ferrous alloys

When material is such that it can be sorted by hand, the buyer cannot reject the entire shipment if less than 50% of the metal is copper or copper bearing alloy. Should the copper and copper alloy content fall below 50%, the entire shipment be downgraded by negotiation.

SOURCE: Materials Recovery System, National Center for Resource Recovery, December, 1972, p. 5-28.

Table VI-16

Specification for Recovered Glass

Liquid:	The cullet sample will show no liquid drainage; it must be non-caking and free-flowing.
Organic Substances:	The cullet will contain a maximum of 1% paper and plastics. On ignition, the sample will lose no more than 2% of its weight (dry weight basis). Ignition will be at 450 degrees C. to constant weight within a minimum time.
Sizing:	100% of the sample will pass through a 2 inch screen and be retained on a 100 mesh screen.
Metals:	The sample will contain less than 0.5% of magnetic metal and less than 0.02% of non-magnetic metal in the fraction above 60 mesh, with a maximum size of either of 1/4 inch.
Refractories:	A one pound sample may not contain more than 2 particles greater than 40 mesh in size nor 20 particles in the size range -40 to +60 mesh. When appropriate, this portion of the specification may be altered to no more than 5 particles greater than 40 mesh in size nor 80 particles in the size range -40 to +60 mesh.

SOURCE: Materials Recovery System, National Center for Resource Recovery, December, 1972, p. 5-30.

Table VI-17

Specifications for Folded News

Grade Title:	Folded News (other grade titles - Regular News, Ordinary Folded News)
Description:	Consists of folded newspapers including the normal percentage of rotogravure and colored sections.
Packing:	Packed in bales of standard dimensions, not less than 54 in. long, approx. 1000-1500 lbs. per bale
Moisture:	Packed air dry
Prohibitive Materials:	Less than 1/2 percent
Outthrows:	Less than 2 percent
Solubles:	Less than 10% of the acceptable paper

SOURCE: Materials Recovery System, National Center for Resource Recovery, December, 1972, p. 5-19.

Table VI-18

Specifications for Mixed News and Old Corrugated Containers

Grades:		
	Residential Grade:	30-40% Old Corrugated Boxes
		60-70% Folded News
	Commercial Grade:	70-80% Old Corrugated Boxes
		20-30% Folded News
	Combines:	50-60% Old Corrugated Boxes
		40-50% Folded News
Packing:		Packed in bales of standard dimensions not less than 54 inches in length, approx. 1000-1500 lbs. each.
Moisture:		Packed air dry.
Prohibitive Materials:		Less than 1 per cent
Outthrows:		Less than 5 per cent
Solubles:		Less than 10% of the acceptable material

SOURCE: Materials Recovery System, National Center for Resource Recovery, December, 1972, p. 5-21.

Table VI-19

Specifications for Old Corrugated Boxes

Grade Title:	Old Corrugated Boxes
Description:	Consists of used corrugated containers having liners of jute or kraft.
Packing:	Packed in bales of standard dimensions not less than 54 in. long; approx. 1000-1500 lbs. each
Moisture:	Packed air dry.
Prohibitive Materials:	Less than 1 percent
Outthrows:	Less than 5 percent
Solubles:	Less than 10% of the acceptable corrugated

SOURCE: Materials Recovery System, National Center for Resource Recovery, December, 1972, p. 5-20.

In evaluating a particular raw material as to its suitability for input to manufacturing or production, a buyer will generally look for more than just the best price. As explained above, the quality of the raw material must be known and a low level of contamination is always desirable. In addition, a steady and reliable supply of the raw material and certain shipping or packaging requirements are common considerations. As the relationship of the buyer and seller of secondary materials matures, adjustments in the specifications of both can lead to mutual benefit.

The basic issue in marketing secondary raw materials is their competitive position with respect to virgin raw materials. The sources of virgin materials are usually far away from the centers of population because of cheaper land or energy. However, the sources of secondary materials are located in the centers of population. Production and manufacturing establishments have traditionally been located strategically with respect to their source of virgin materials. A shifting of emphasis from virgin to secondary materials as a source disrupts the carefully planned location strategy. The net change would be reflected in increased handling and transportation costs for secondary raw materials.

Implicit in any system of recycling is a relative de-emphasis of virgin resource production. For every ton of secondary material recycled, there is a ton of virgin material which will not be produced. This reordering of materials flow is, of course, one of the prime objectives of a resource recovery program; but it must be realized that some degree of economic disruption is included in this change. Some jobs would be lost in the virgin production industry and some jobs would be gained in the resource recovery and secondary materials industries; retraining is implied. Some capital items would be idled in virgin production and some new capital items required for solid waste processing. Ironically, the equipment used in the extraction industries for refining and separating the desired material from its ore and other impurities has been the technical base used for design of equipment to separate solid waste materials from their "ore," and in some cases, exactly the same machine is used. It is not known whether simple conversions might be able to greatly reduce the economic impact of transition from extraction of resources to recycling resources.

The last area of secondary materials marketing where some general statements are applicable is price stability. Secondary materials markets are notoriously fluctuating; price variations of several hundred percent over a few months are not uncommon with some materials. Most secondary materials are created as a response to demand for some other material - not the secondary material. For example, if there is a demand for a beverage, a container is created as well. Consequently, the secondary materials are <u>indirectly</u> connected with supply and demand of the economy as a whole. Because the supply and demand for secondary materials are not <u>directly</u> connected to the economy, they are frequently out of phase; inventories of recycled materials will often be high when demand for them is low and supplies will be low when demand is high; it rarely seems to reach equilibrium. Naturally, the price of the secondary material is tied to the supply/demand situation and thus also fluctuates widely. These fluctuations are very hard for manufacturers and producers to cope with. They usually prefer to use the virgin materials which have traditionally had a steady price. Secondary materials prices vary because they are truly subject to the laws of supply and demand. Other commodity industries, as they have become institutionalized, have relied upon internal strength and supplies to maintain their prices.

Ferrous Metals

Iron and steel products are made from two raw materials, iron ore and scrap, plus very small amounts of other materials which facilitate the process. Iron ore is transformed into pig iron in blast furnaces and is then ready to be mixed with scrap in the production furnace from which the final iron and steel products are drawn. There are three types of production furnaces used, each using a certain ratio of scrap to pig iron. Table VI-20 presents some comparative data on the use of the three types of production furnaces in 1968.

Table VI-20 [1]
SCRAP USE BY TYPE OF PRODUCTION FURNACE

Type of Production Furnace	% of Total Production by Type	Approximate Percentage of Scrap used by Type
Open Hearth	50%	42%
Basic Oxygen	37%	29%
Electric	13%	98%
Total	100%	

Trends in the steel making industry have seen a gradual decline in scrap consumption as a percent of total production, however, this decline is expected to level off.[2] Total scrap consumption has stayed about the same.

Scrap iron and steel are sold according to grade. The highest grades are heavier, cleaner, and of known origin. The lowest grades are mixed sizes and types of uncertain origin. From the viewpoint of the steel industry, the most desirable scrap is "home" scrap or scrap that is generated internally by a steel manufacturer's own operation. Origin and composition are known, there are no material costs, and no transportation is required. Second most desirable is "prompt" scrap, or iron and steel remnants left over from steel fabrication. Least desirable scrap is called "obsolete" scrap which is ferrous metal which has completed its useful life; any ferrous metals recovered from municipal solid waste or steel from obsolete autos would fall into this last category. Almost 60% of all scrap consumed is "home" scrap, about 25% is "obsolete" scrap, mostly auto, and "prompt" scrap accounts for about 15% of all scrap utilized.[3] The steel industry is quite careful to recycle all its own wastes because it is valuable. The industry only seeks "obsolete" scrap to supplement the 75%± scrap generated from within.

Given the existing numbers of the three types of production furnaces in the U. S. and given the maximum technically feasible rates of scrap use for these furnaces, it is estimated by Midwest Research Institute that between 1 1/2 and 2 times the existing tonnage of scrap could be consumed.[4] It is clear that technical limitations in production furnaces do not stand in the way of increased scrap consumption. Neither is the level of metalic impurities in "obsolete" ferrous a technical limitation. The steel industry is already obtaining its minimum requirements of "obsolete" (25%)from existing secondary materials sources and since they would rather use pig iron than use more "obsolete" scrap, their consumption patterns are understandable.

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[1] Salvage Markets for Materials in Solid Wastes, Darnay & Franklin, MRI, for the EPA, (1972), page 48

[2] Ibid, pp. 48 and 49

[3] Ibid, p. 58-2

[4] Ibid, p. 50

How then do we recycle more of the "obsolete" ferrous scrap? There is no shortage of it and the steel mills could use it if they desired. The problem is that "obsolete" scrap is simply more expensive than the alternative, pig iron. Thus, there are only two ways that "obsolete" scrap consumption could be increased: 1) increase total output of steel so that minimum requirements would cause need for more input and 2) change the price of scrap in relation to the price of pig iron. Certainly, the first way is of only short term significance because if total production is up eventually total "obsolete" scrap available will be up. Basically, there is only one solution: A change in the favorable position of pig iron (iron ore) with respect to "obsolete" scrap.

In terms of the existing concepts of pig iron and "obsolete", there is no doubt that pig iron is qualitatively superior. There are costs involved in upgrading "obsolete" to the point where it is the qualitative equal of pig iron and these costs would have to be borne somewhere if scrap is to be used. It must be cleaned, sorted, identified, baled, and transported among other things. Presently, a vast amount of "obsolete" scrap is termed "inaccessible" because if it were suitably processed, its cost would exceed the cost of pig iron.

The costs of upgrading scrap could be borne by almost any element of the system; the producer, the municipality or the consumer, depending on the type of implementation. Using more "obsolete" scrap in steel production will probably raise the cost of steel, however, there are some potential savings available in other areas. For instance, the recovered ferrous would not have to be disposed and somewhat less iron ore would be mined not to mention the intangible environmental savings.

Alternatives to directing recycled ferrous back to the steel mills are 1) using can scrap for precipitation of copper from low grade ores and 2) detinning to recover the highly valuable tin. Shredded steel-tin cans are ideal for the copper mining operation although there is a limited and distant demand for them which is already being met by incinerator residues and detinning factories. Although some of the Bay Area's steel cans are now used for copper precipitation, it is doubtful that there is potential for great expansion in this market. Cans from other parts of the country will always have a locational advantage.

Detinning is a possibility although presently uneconomical. Detinners accept only clean tinplate scrap from industrial sources at the present time. Again, the problem is similar to preparing "obsolete" scrap for steel production in the sense that the scrap must be cleaned and prepared in order to compete qualitatively with the alternative raw material. After preparation, the scrap costs too much.

Detinning is an important consumer of ferrous scrap for several reasons. Detinning represents true recycling of materials rather than just reclaiming them for another purpose. Tin is very valuable, almost $3,500 per ton in 1970.[1] Perhaps most important is that about 73% of the tin consumed in the U.S. is imported.[1] The very same factors which are causing this country to seek self-sufficiency in the case of oil apply to tin as well, namely, a burden on our balance of payments and our vulnerability to "embargoes" and severe price increases. Detinning of "obsolete" scrap cans offers a good possibility for resource recovery if the economic questions can be resolved. There are three detinning plants in California now, one in San Francisco.[2]

Nonferrous Metals

Of the principal nonferrous metals in solid waste, aluminum, copper, zinc and lead, almost half is aluminum. Aluminum is being increasingly used as a packaging material and its consumption is growing faster than the other nonferrous metals. There are many more nonferrous metals but they are not commonly found in solid wastes and are usually recycled very well now when possible due to their extremely high values.

Zinc is a metal which is almost never used by itself, but rather as a coating or somehow closely attached to other materials in castings. Consequently, zinc is rarely available in a pure form which accounts for its relatively low rate of recycling in spite of its moderately high value ($306/ton in 1970[3]). Only 15.3 percent of total zinc consumption came from scrap in 1967.[4]

Copper in municipal solid waste is mostly found in electrical items: small and large appliances. Proposed modes of resource recovery would direct the large items to automobile shredders and separation equipment where the copper would be picked up with the sizable fraction of copper found in autos. The copper in the smaller items would be mixed in with the other nonferrous metals. Existing copper recycling activity is high because so much of it is used by utilities and other industrial users. In 1967 scrap copper was 53% of total production. Introducing additional scrap copper into the existing secondary markets would have minimum impact other than to idle an equivalent portion of the primary copper mining or importing industry.

[1] Statistical Abstract of the United States, 1972, Table No. 1119

[2] Progress Report on Recycling, American Iron & Steel Institute

[3] Statistical Abstract of the United States, 1972, Table No. 1122

[4] Darnay and Franklin, Salvage Markets for Materials in Solid Wastes, Midwest Research Institute for EPA, 1972, Table 40, page 64-2.

Lead is recycled presently in a manner quite similar to copper. Reuse rate is high, 57.6%[1]. Most lead is used in storage batteries where the system of "trading in" an old battery for a new one has encouraged a high rate of recovery. Again, because the secondary material market and system is already well developed, problems of recycling the small amount of additional lead found in municipal solid waste should not be significant.

The important nonferrous metal is aluminum due to the quantities involved and the trend toward using this metal in new ways. While total municipal solid waste generation is growing at about 1 to 2% per year, aluminum in solid waste is growing over 15% per year.[2] Most of the aluminum is in the form of beverage cans.

The structure of the aluminum industry is similar to the iron and steel industry. There are integrated primary aluminum producers and nonintegrated secondary smelters. Both have capacity for accepting scrap. About 70% of all scrap in 1967 was consumed by the secondary smelters, about 14% consumed by the primary producers and the remaining 16% consumed by assorted fabrication, foundry and chemical plants.

Like the steel industry, secondary aluminum consumers prefer certain types of scrap over other types. "New" scrap, the more desirable, is composed of the residue from casting and milling operations and is analogous to "home" and "prompt" scrap in the steel industry. "Old" scrap in the aluminum industry is obtained from junked airplanes, scrap aluminum foil, dismantled autos, scrapped power cables, aluminum cans and discarded household appliances.[3] "Old" aluminum scrap is analogous to "obsolete" steel scrap. The "new" scrap is more desirable because it comes from industrial sources, tends to be cleaner and is of known origin.

The economics of aluminum recovery already appear to be favorable. While primary aluminum is preferred in cases where a high level of purity is required, most uses of aluminum do not require this degree of purity. Secondary ingot competes with the primary ingot and is about 21% less costly.[4] This 21% savings can be viewed as a source of funds to help offset the cost of sorting "old" aluminum from other solid wastes. In other words, up to $121/ton can be spent to recover secondary aluminum before primary aluminum becomes more economical to use. Further, this type of accounting does not take in the environmental benefits of recovering the waste and saving the bauxite and energy resources used in primary production.

Another tangible saving involved using secondary aluminum is shipping costs. Primary producers locate their plants in the distant points where electricity is cheap because primary production requires vast amounts of energy. Consequently, freight costs to ship their product back to the areas where it is used, the municipalities, are high. On the other hand, secondary production does not use exceptional amounts of power and can be located near the municipalities, thus saving some shipping costs. These cost savings also tend to better the competitive position of recycled aluminum.

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[1] Darnay and Franklin, Salvage Markets for Materials in Solid Wastes, Midwest Research Institute for EPA, 1972, Table 40, page 64-2.

[2] Ibid.

[3] Ibid., page 60.

[4] Statistical Abstract, Table 1124, 1970 Data.

Finally, aluminum is among the materials of international economic significance. The raw material for production of primary aluminum, bauxite, is found in concentrations in only a few places in the world; Surinam, the Dominican Republic, Jamaica, Guinea, Australia and to a lesser extent, Alabama, Arkansas and Georgia.[1] In 1970, the U.S. imported about 86% of the bauxite used for production of primary aluminum.[2] Consequently, this country is in a poor position to control its source of raw material and may find itself vulnerable to "embargoes", and exorbitant price increases, not to mention the dollars that flow out of the country. The future possibility of producing aluminum from Georgia Clays found abundantly in this country also leaves some question concerning the best possible strategy. These problems and potential problems make aluminum recycling all the more attractive from a political and economic point of view.

Glass

In contrast to the previous two categories of metals, the potential for economical glass recycling does not appear to be high. The reason for this outlook is two fold: the low cost and virtually infinite supply of alternative virgin raw materials and the high degree of internal scrap production/consumption.

Glass producers are divided into three segments, containers, flat glass and pressed and blown glass. The glass container industry is by far the most significant because it produces 73% of all glass[3] and produces more of the glass which commonly goes into municipal solid wastes. The following two tables prepared by Midwest Research Institute show the use of glass containers by percent and focus in on the important beer and soft drink container industry.

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[1] NCRR Bulletin, Spring 1974, pages 18 and 19

[2] Statistical Abstract, 1972, Table 1123

[3] Darnay and Franklin, Salvage Markets for Materials in Solid Wastes, MRI for EPA, 1972, p. 65.

Table VI-21

SHIPMENTS OF GLASS CONTAINERS BY END USE, 1967-1970, IN MILLION UNITS AND PERCENT*

Category	Units 1967	Units 1968†	Units 1969	Units 1970†	Percent 1967	Percent 1968	Percent 1969	Percent 1970‡
Food	11,872	11,183	11,901	11,814	36.0	35.0	32.9	31.5
Beverages	14,709	15,411	18,431	20,333	44.7	48.2	51.0	54.1
Liquor	1,980	1,731	2,003	1,784	6.0	5.4	5.6	4.8
Wine	822	829	975	988	2.5	2.6	2.7	2.6
Beer	6,408	6,460	7,356	7,598	19.5	20.2	20.3	20.2
Returnable	624	475	480	350	1.9	1.5	1.3	0.9
Nonreturnable	5,784	5,985	6,876	7,248	17.6	18.7	19.0	19.3
Soft drinks	5,499	6,391	8,097	9,963	16.7	20.0	22.4	26.5
Returnable	1,913	1,747	1,640	1,603	5.8	5.5	4.5	4.3
Nonreturnable	3,586	4,644	6,457	8,360	10.9	14.5	17.9	22.2
Medical and health	3,255	2,887	3,355	3,176	9.9	9.0	9.3	8.5
Toiletries and cosmetics	2,290	1,842	1,817	1,694	6.9	5.8	5.0	4.5
Chemicals	816	624	647	540	2.5	2.0	1.8	1.4
Total	32,942	31,947	36,151	37,557	100.0	100.0	100.0	100.0

*Current industrial reports. Glass containers. Series M32G. 1967; 1968; 1969; 1970.
†Shipments were affected by a 51-day strike.
‡Estimated by MRI on the basis of 8 months data.

SOURCE: Darnay and Franklin, Salvage Markets for Materials in Solid Wastes, MRI for EPA, 1972, p. 71-2.

Table VI-22

BEER AND SOFT DRINK FILLINGS AND CONTAINER CONSUMPTION, 1967-1970 IN MILLION UNITS*

	1967	1968	1969	1970†
Soft drink:				
Glass closures	32,715	31,046	36,133	35,349
Metal cans	7,290	10,028	11,764	12,856
Glass container shipments:				
Returnable	1,913	1,747	1,640	1,603
Nonreturnable	3,586	4,644	6,457	8,360
Total fillings‡	40,005	41,074	47,897	48,205
Market share %:				
Metal cans	18.2	24.4	24.5	26.6
Returnable bottles §	72.8	64.3	62.0	56.1
Nonreturnable bottles	9.0	11.3	13.5	17.3
Avg. no. trips, returnable bottles¶	16	15	14	n.a.
Beer:				
Glass closures	17,003	16,092	17,834	17,747
Metal cans	13,769	15,342	16,708	18,864
Glass container shipments:				
Returnable bottles	624	475	480	350
Nonreturnable	5,784	5,985	6,876	7,248
Total fillings‡	30,772	31,434	34,542	36,611
Market share %:				
Metal cans	44.7	48.8	48.4	51.5
Returnable bottles §	36.5	32.2	31.7	28.7
Nonreturnable bottles	18.8	19.0	19.9	19.8
Avg. no. trips, returnable bottles¶	19	20	20	n.a.

*Current industrial reports. Glass containers. Series M32G; Metal cans. Series M34D; Closures for containers. Series M34H. 1967; 1968; 1969; 1970. Annual report--metal can shipments--1968. Washington, Can Manufacturers Institute.

†Estimated by MRI on the basis of 8 months data.

‡Total fillings is total crowns and other closures for glass bottles plus total metal cans for the beverage category.

§Calculated as a percent of total fillings, not putput of returnable containers.

¶Estimates by Glass Container Manufacturers Institute in Glass Containers, 1970.

SOURCE: Darnay and Franklin, Salvage Markets for Materials in Solid Wastes, MRI for EPA, 1972, p. 71-3.

Glass containers have recently been in stiff competition with aluminum, steel and plastic, each trying to increase their share of the container market. Most of the declines shown on Table VI-21, such as with toiletries and cosmetics, are attributable to inroads in that market by metal and plastic containers rather than a decline in the total market. Clearly, the future success of the glass container industry is tied to the success of the nonreturnable beer and soft drink container.

Raw materials for glass production are very inexpensive and plentiful. The materials are mostly sand, some soda ash and limestone and limited amounts of other materials. Cullet, or scrap glass, is also a desirable raw material because it melts at a lower temperature than the sand and saves energy and furnace life. Cullet utilization varies from 8% by weight to 100%; the average is estimated to be 14 to 16% for glass containers.[1]

In spite of the advantage of using cullet in glassmaking, very little post consumer cullet is sought by the industry. The same inhibitors are present in the glass industry as in all others, that is, a lack of knowledge of the chemical composition of the post consumer cullet and lack of a steady, reliable supply. Some glassmakers totally avoid post consumer cullet. Instead, a large amount of cullet which is generated in the glassmaking process is kept in the plant. This cullet is the result of spills, trimmings and off spec batches. It is not uncommon for glassmakers to intentionally turn out a batch of cullet for their own use. Use of noninternal cullet is estimated to be only about 1% of total raw material input, and most of that amount is relatively clean trimmings bought from other plants. Only recently have glassmakers begun to use small amounts of post consumer (recycled) glass collected by community recycling centers. Other uses of recycled cullet are as aggregate in asphalt and concrete and in making reflective devices.

Newspaper

All types of paper are a unique case in resource recovery because the current state of technology only permits a low recovery rate and the material recovered is of the lowest quality. The fiber material recovered by the Black-Clawson system, the only firm experimenting in this field, is only suitable for reuse in roofing felt and similar uses. Notwithstanding any technological breakthroughs (which are not anticipated in view of the lack of interest in this area) frontend separation of paper does not appear to be an effective use of paper resources in municipal solid waste.

For paper as a whole, there seems to be only two practical general approaches to resource recovery, source separation and/or energy recovery. Weighing these two alternatives, the following quotation from Dr. John B. Skinner of the Federal Office of Solid Waste Management cites the basic issue:

"In general it is preferrable to recover paper through separate collection and recycling as a fiber source rather than burning and converting to energy. As a fiber source paper is worth from $30 to over $100 per ton, while as a fuel, paper is only worth a few dollars per ton.

"It should be noted that paper recovery and energy recovery are not incompatible. For example if 60 percent of the newspapers, corrugated and mixed office papers were extracted from the waste stream, the energy value of the remaining wastes would only be reduced by 7 to 9 percent of a per ton basis."[2]

[1] Darnay and Franklin, Salvage Markets for Materials in Solid Wastes, MRI for EPA, 1972, p. 66.

[2] Skinner, "Resource Recovery: The Federal Perspective," Waste Age (January/February, 1974), Reprint.

Two methods of source separation of newspaper have been used by local collectors: 1) weekly or monthly collection by a separate truck, and 2) weekly collection by the regular packer trucks in separate racks, the so-called "piggyback" system. Both systems rely upon citizen participation with a small amount of inconvenience but produce substantial volumes of clean newsprint for recycling. The planning, coordination, administration, and promotion of source separation programs are the important elements because a high and consistent level of citizen participation is the key to success of the program.

Considerably more secondary newsprint could be used by the paper mills than is currently being used. Nationally, only 7½% of the input fibrous material in newspaper is paper stock (recycled); the remaining 92½% is wood pulp.[1] Technically, newsprint can be made from 100% paper stock by a process patented by the Garden State Paper Company in New Jersey and Pasadena, California. The basic process of newsprint reuse is called deinking. The reason wood pulp is favored is because it is usually cheaper than paper stock and tends to produce a higher quality of paper.

Paper stock consumption has been on a downward trend for several years while total paper consumption and wood pulp use have been on a steady upward trend. This relationship of paper mills to wood pulp has encouraged the mills to locate close to the forest where wood pulp handling costs will be minimized. Consequently, there are added transportation costs in delivering collected newsprint from the municipalities to the distant mills for reprocessing.

If the current low levels of paper stock use continue, the relative values of wood pulp and paper stock are expected to be unchanged until about 1980 when a projected timber shortage would be expected to cause a shift in favor of recycled paper stock. If a greater percentage of recycled paper stock is used now, the timber shortage (pulp-wood) is not expected to occur. Although the trend in paper stock (recycled paper) consumption since 1950 has been a declining percentage of use, this trend is already leveling off. If the trend can be turned into an increasing percentage of use, the crisis of a pulp-wood shortage should be avoidable.

Corrugated Cardboard

Corrugated cardboard is the most plentiful fiber based material in municipal solid wastes. At the same time, corrugated is recycled at a rate higher than most other paper products; about 23% of the recycled corrugated is post consumer waste. Some additional corrugated is recycled "in house" by the cardboard container fabricators.

[1]Darnay and Franklin, Salvage Markets for Materials in Solid Wastes, MRI for EPA, 1972, p. 45-2.

Corrugated is recycled effectively because it is primarily generated by commercial and industrial establishments. These businesses generate such quantities of corrugated that it is a serious disposal problem for them. By the same token, the concentrations permit the efficient collection of the material. Almost all large supermarkets and other big users of corrugated are baling their own scrap cardboard into 500-700 lb. pallets for pickup by the broker. The brokers will usually pick up unbaled corrugated as well but the establishment will receive less for it. The cost of this baling equipment is small and can be amortized quickly by a suitably large business establishment.

The markets for corrugated cardboard are already established locally. Because the approach to materials recovery of paper products is optimized by a source separation program, only incremental supply changes would be initially expected. Under these circumstances of gradual change, economic disruptions due to increased efforts to source separate and recycle corrugated and newsprint should not be great.

3. Possible Methods of Stimulating Demand for Secondary Materials and Stabilizing Market Conditions.

As explained in the previous section, the primary reason that secondary materials have not been recycled is that there has not been a demand for them. The two basic reasons why demand has been low are because 1) the secondary materials often appear to be more expensive than the virgin alternative and 2) potential consumers of secondary materials do not have confidence in the quality of the available materials. Consequently, the possible solutions to the problem of low demand lie in the same two areas: changing the cost of secondary materials in relation to virgin materials, and effecting changes and programs that will bring confidence and stability to the market.

It is important to note that the alternatives following are usually interdependent, that is, changes in one area are very likely to cause changes in other areas. As an example, simply placing a deposit on a glass beverage container in order to raise its value and thus facilitate its recycling would probably not have the desired effect. Instead, manufacturers and consumers would switch to some other type of container - steel, aluminum or plastic. This example is given to show that care must be taken in making changes in markets because the effects can easily reach further than anticipated.

Demand for materials in solid wastes is inextricably tied to their value relative to the virgin or other alternative. Demand can be increased by either lowering the cost of secondary materials or raising the cost of virgin resources. Some forces are already acting to cause movement in this direction. Technological solutions to materials recovery will inevitably lower the unit cost of separation in addition to creating a vast supply. With the same sense of inevitability, virgin resources are becoming more scarce and more distant.

Taxation is a common way for government to implement policy decisions. With respect to materials recovery, two general types of tax changes appear possible: 1) reduction or elimination of taxes on resource recovery from solid waste and 2) increase of taxes on virgin material extraction industries. Because most virgin material extraction industries now enjoy a tax subsidy in the depletion allowance and foreign tax credits, perhaps a simple return to a completely equal and free market would accomplish the desired adjustment. Taxation, of course, is basically the responsibility of the Federal and State governments. Local government could only lend support and encourage tax laws that effect resource recovery.

It is clear that transportation cost is very important if secondary materials are to get to a market. The value of these materials is usually so low that transportation costs are difficult if not impossible to absorb. A study[1] by the EPA indicates that transportation is a significant (over 30% of value) factor in glass, paper and ferrous metal recycling. Actual rate discrimination in favor of virgin material shipping costs in the western part of the country is experienced by secondary glass and ferrous metals. Although this situation is also a federal matter under the jurisdiction of the Interstate Commerce Commission, local government can voice policy in this area.

Another side of the transportation problems of recovered solid waste materials is in the area of producer/consumer location relationships. Local governments can facilitate in this area. Planning should include adequate and well served industrial lands convenient to the materials recovery plant(s) which will be attractive to many consumers of secondary materials. Transportation and handling costs can be made less significant and use less energy if the consumption of recycled materials is encouraged locally.

Demand for secondary materials can also be artifically created. Often suggested are government standards for minimum usage of recycled materials in products bought by government. Similarly, minimum standards could be applied to all products sold. These measures would instantaneously create a demand for secondary raw materials. This type of "artificial" demand created by policy or law would tend to increase the cost of goods made from recycled materials. In the last analysis, if recycling is superimposed upon industries where no natural demand otherwise existed, the consumer will pay whatever amount in additional unit cost is required to cause the recycled materials to be sought. In a sense, the consumer would be subsidizing the recovery of material resources in solid wastes.

The stability of secondary materials markets is essential to the success of recycling. A steady supply and demand situation allows producers and consumers of secondary materials to better meet each others needs and work efficiently. In planning a solid waste processing facility, the recovered output should be a substantial amount of material. Adequate concentrations of secondary material are required to attract buyers. One excellent way to stabilize the buyer/seller relationship is with a contract. When a contract is in place, the buyer will agree to purchase a given quantity of recovered material at a certain minimum price. If this quantity and price are satisfactory to the seller, the solid waste facility, the materials will flow for the term of the contract. The contract gives the buyer confidence in the supply availability and gives the seller confidence in the price.

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[1] Resource Recovery and Source Reduction, EPA Publication #SW-122, 1974.

Another technique to attract buyers is to guarantee the maximum level of contamination of recovered output materials. A "batch" of recovered material that does not meet the specifications could be either rejected or renegotiated by the buyer. Such a guarantee would naturally be a part of a supply-price contract.

Certain kinds of materials create problems for solid waste processing facilities because they are difficult to sort out. By limiting or banning the input of these materials to the system, a great increase in the quality of the output can be realized. The qualitatively superior output is always more valuable. An example of a material in solid waste that is difficult to handle is the bimetalic beverage can. Existing separation equipment will direct the aluminum in these cans into the ferrous metals bin, a contamination. While this small amount of aluminum is normally acceptable if the cans are to be remelted or if the cans are to be used for copper precipitation; it is a serious problem if the cans are bound for detinning. Other situations where the characteristics of the input material create problems for materials recovery equipment and programs are the clay impregnated (glossy) inserts in newspapers, and plastic coatings or multi-material laminated packaging. The aluminum ring top glass bottles which have always been a contamination problem with community hand sorted recycling centers are not a problem for a modern front-end system.

Another group of materials, while not a unique problem to process in a solid waste facility, are nonetheless used inefficiently. These materials, mostly paper and some plastics and rubber, once in the solid waste are not likely to be recycled and will only be used for energy recovery. The strategy for materials in this category should probably be to restrict or limit their input into the solid waste stream to the degree that this is practical. The recent appearance of plastic bottles in the grocery stores represents a course of events that is inefficient and counter-productive with respect to the outlook for solid waste management.

The topic of product specifications where certain products are controlled or even banned is necessarily controversial because it is often discriminatory. Ideally, through negotiations and compromise, new products will change to take into account their ultimate post consumer reclamation. This type of change would be facilitated if the buyer of the secondary material were the same company that originally produced the new product. Problems and costs would be kept internal for that company and the problems and costs would naturally find their best solution. If the materials recovery plant output could be improved qualitatively by some adjustment of the post consumer waste input, that adjustment is likely to occur when one company or industry is handling both the input and the output.

VII. GENERAL PLANNING POLICIES AND REGULATIONS

A. Federal Policies and Regulations

1. Environmental Protection Agency

The Environmental Protection Agency is responsible for administration of major federal environmental legislation, listed below, and of federal assistance programs for the development and maintenance of state and local environmental control programs. EPA is also authorized to adopt appropriate standards for environmental pollutants.

Air Quality Act of 1967 requires states to establish air quality standards and regulating control programs.

Clean Air Act Amendments of 1970 require EPA to set national ambient air quality standards. In 1971, EPA established primary and secondary standards for six classes of pollutants. States must submit implementation plans to achieve national air quality standards by 1975 and to maintain national standards through air pollution control strategies, including source emission limitations and land use and transportation control measures.

Water Quality Act of 1965 provides that States set water quality standards.

California Water Quality Standards were fully approved on January 9, 1969.

2. National Environmental Policy Act of 1970 requires every agency of the Federal Government to take into account, and make public, the environmental impact of each major action, as well as to discuss alternatives which were considered and which might minimize environmental damage.

3. Federal Assistance Programs are regulated by "Circular No. A-95" prepared by the Office of Management and Budget. The Circular requires that all applications for federal domestic assistance document comments and recommendations of the appropriate State or regional clearinghouse to assure maximum consistency of proposed federally assisted projects with State, regional, and local comprehensive plans. Circular 95-A also regulates direct Federal development projects. Important federal programs, requiring state and regional clearinghouse review, include:

- Corps of Engineers Flood Control Projects
- Department of Housing and Urban Development, Community Planning and Development, New Communities loan guarantees
- Department of the Interior, Bureau of Outdoor Recreation financial assistance for acquisition and development of outdoor recreation areas and facilities
- Department of the Interior, Bureau of Reclamation reclamation projects, loans, and services
- Department of Transportation, Federal Highway Administration Federal-Aid Highway Program
- Department of Transportation, Urban Mass Transportation Administration grants and loans
- Environmental Protection Agency Air Pollution Control Program grants, Construction Grants for Wastewater Treatment Works, Water Pollution Control Grants

B. State Policies and Plans

1. Legislation Creating

The State Solid Waste Management Board (consisting of ten members) was approved by the Governor on July 13, 1972 (Government Code, Title 7.3). The Board was required to adopt state policy for Solid Waste Management and Resource Recovery by January 1, 1975. The legislation also created the twenty-five member State Solid Waste Management and Resource Recovery Council.

The Board is responsible for all matters relating to Solid Waste Management including research, development, special studies and demonstration projects, pilot resource recovery projects, state-wide data retrieval system, public information program, technical assistance to state and local agencies, studies of litter control and alternative means of providing financial assistance to local agencies.

2. Air Resources Board

The Air Resources Board is empowered by the Mulfold-Carrell Air Resources Act to adopt standards of ambient air quality for each of California's ten State Air Basins. The Air Resources Board, working with local Regional Air Pollution Control Boards, is responsible for development of implementation plans to attain air quality standards adopted by the federal government. The plan must provide for land use and circulation controls, source monitoring, air quality monitoring, and a procedure for review, prior to construction, of the location of new sources of air pollution.

3. Department of Conservation: State Geologist

Recently amended California statutes call for the State Geologist to delineate special study zones to encompass all potentially and recently active traces of the San Andreas, Calaveras, Hayward, San Jacinto Faults, and other faults sufficiently active and well defined to constitute a potential hazard. The Alquist-Priolo Hazard Zones Act also requires the State Mining and Geology Board to adopt policies and criteria for land within designated Geologic Hazards Zones. The act provides that local agency development proposals be in accordance with state criteria and policies.

4. Department of Transportation

The Department of Transportation is responsible for preparation of a California Transportation Plan. Plan preparation was initiated in 1973. The California Transportation Plan will include the plans and policies of regional transportation agencies, and will be generally consistent with the recently adopted Regional Transportation Plan of the Metropolitan Transportation Commission. When completed, the State plan will include a schedule of improvements, an operations program, and recommended State legislation to implement the California Transportation Plan.

5. Water Resources Control Board

The State Water Resources Control Board functions include licensing the appropriation of water, control and prevention of water pollution and enhancement of water quality, and planning and research to support adjudicatory and regulatory functions. The Board administers the 1970 Porter-Cologne Water Quality Control Act and the Clean Water Grant Program, and serves as the State clearinghouse agency for certification of local public and private projects to the Environmental Protection Agency for wastewater treatment works construction grants. It is the policy of the Board to fund and certify only projects or portions of projects needed "to accommodate normal anticipated growth and reasonable reserve capacity." In the San Francisco Bay Region, one of California's two Critical Air Areas, Board policy provides for treatment capacity to serve ten-year population needs as based on Department of Finance Series E, fertility, and 0, net-inmigration projections. Board regulations provide that "no allowance by made for capacity to serve new independent and undeveloped areas, or to serve areas which were, or are, designed primarily as a separate unit independent from the already existing community, unless the division finds that such allowance is necessary for protection of water quality."

C. Regional Policies and Plans

1. Association of Bay Area Governments (ABAG)

The Association of Bay Area Governments was created by Bay Region cities and counties in January, 1961, to provide a framework for governmental units to work together in solving regional problems and to formulate and implement regional development policies. The Association's formal organization is provided by contractual agreement between member cities and counties acting under authority of the Joint Exercise of Powers Act of the State of California.

ABAG regional plans and policies include the "Regional Plan 1970-1990," "Regional Open Space Plan - Phase II," "Regional Airport Systems Plan - Phase II," "Regional Water, Sewerage and Drainage Program, Phase II - Initial Plan," and General Assembly Policy Statement "Formulation of Long-Range Regional Growth Policy - II."

a. Regional Plan 1970-1990, including the Plan Diagram, was approved by the ABAG General Assembly on July 30, 1970. The Regional Plan represents a city-centered regional growth policy. Plan policy guidelines and the plan diagram are based on the following regional objectives:

- Identifiable Concentrations of Urban Development Around Community Centers
- Extensive Open Space and Conserved Areas
- Improved Environmental Quality
- A Multiple-Mode Transportation System
- An Operational Regional Organization
- Strong Intergovernmental Cooperation, Coordination and Citizen Participation

The Regional Plan Diagram, Major Land Uses and Transportation Facilities, indicates geographic areas where particular categories of land use would be compatible with ABAG objectives, provided development is consistent with the Plan's criteria and standards.

b. Regional Open Space Plan - Phase II was approved by the ABAG Executive Committee as an interim element of the "Regional Plan" on April 20, 1972. The Plan identifies open space functions that might be served by open space areas of the "Regional Plan;" these open space funtions include:

- Managed Resource Production
- Natural and Human Resources Preservation
- Human Health, Welfare, and Well-being
- Public Safety
- Outdoor Recreation
- Shaping Urban Growth

c. Regional Airport Systems Study: Final Plan was adopted on November 30, 1972, as a Special Plan Element to the Association's "Regional Plan." The Study presents a plan for a regional airport system and has been incorporated into the "Regional Plan" as its aviation plan element.

d. Regional Water, Sewerage, and Drainage Program, Phase II - Initial Plan was approved by ABAG Executive Committee to serve as a preliminary water, sewerage and drainage plan, required by the Department of Housing and Urban Development, and to provide a guide for grant review until a final plan is adopted. The Initial Plan includes planning objectives and guidelines, and short- and long-range water, sewerage, and drainage plans for the subregions of the Bay Area.

Recommended short-range programs for the Livermore-Amador Valley (part of the Alameda-Contra Costa Subregion) include:

- Water: Expansion of groundwater recharge facilities, continued groundwater use at rates less than known recharge rates, and construction of filtration plants for direct utilization of South Bay Aqueduct waters, as necessary to assure adequate treatment of all surface water supplies.
- Sewerage: Subregional coordination of sewage facilities to meet requirements of the State Water Quality Control Board.

Recommended long-range plans include:

- Water: Long-range plans for water projects are being made by major water supply agencies in the Livermore-Amador Valley subregion.
- Sewerage: Consolidation of existing Livermore-Amador Valley treatment facilities into one plant. High priority need for an economical answer to problems of high dissolved solids in wastewater.
- Drainage: Need for a long-range plan for drainage, and for maintenance of high standards of water quality in storm runoff.

e. Policy Statement: Formation of Long-Range Regional Growth Policy - II was adopted by ABAG General Assembly Resolution No. 3-73 on October 11, 1973, to serve ABAG in preparation of study and planning proposals, commentary on federal grants under A-95 (clearinghouse review) and Environmental Impact Statements required under Federal NEPA Act of 1969, and review of plans of public and private organizations bearing upon the nine-county Bay Area.

The Policy Statement establishes year 1980 and 2000 Regional Growth Quantities and Growth Quantities Range, provides for cooperation with local and regional level governmental agencies to formulate subregional explicit growth policies, and establishes criteria for plans and project review. Review Criteria require:

- Special justification for proposals encouraging development not related to committed growth patterns or existing service areas;
- Special justification for proposals indicating continued reliance on the automobile;
- Commitment to meeting housing needs with specific provision for low- and moderate-income households;
- ABAG consideration of selected social, economic, and physical/environmental criteria during plan and project review.

2. <u>Bay Area Air Pollution Control District (BAAPCD)</u>

The Bay Area Air Pollution Control District was created by the California Legislature in 1955 and is responsible for policing non-vehicular sources of air pollution within the Bay Area, primarily industry and burning. The District is also authorized to cite smoking vehicles, although the main automotive control grogram is administered through the State Air Resources Board.

To date, the District has enacted six regulations:

- <u>Regulation One</u> bans dump fires and backyard trash burning, and subjects agricultural burning to meteorological controls.
- <u>Regulation Two</u> directly controls particulate matter, sulfur compounds, lead, nitrogen oxides, odorous substances from industrial and commercial sources, and several types of emissions from incinerator operations.
- <u>Regulation Three</u> controls emissions of "reactive" gases, affecting the formulation, storage, shipment, and use of such materials as solvents, paint, gasoline, and ink.
- <u>Regulation Four</u>, which required residents of Contra Costa County, Napa County, and portions of Sonoma and Solano Counties to install crankcase control devices on 1955-1962 model cars with transfer of ownership, has been superseded by recent developments in state law which impose similar requirements on a statewide basis.
- <u>Regulation Five</u> defines air pollution Alert, Warning, and Emergency stages and explains actions required for each condition. A similar multi-level episode plan was recently adopted by the Air Resources Board for statewide use.
- <u>Regulation Six</u> gives members of the District's Vehicle Patrol the authority to cite and arrest indiciduals observed to be violating Vehicle Code automotive emissions provisions.

Perhaps the most important indirect control on air pollution is exercised through the District's permit requirements, set out in Division 13 or Regulation Two. The permit provisions require anyone wishing to build or expand a source that emits air contaminants to first apply to the BAAPCD for a permit to build and submit plans and specifications for evaluation by District engineers. Permits to build will be denied if it is determined that such a facility would not meet any of the District's emission requirements or would cause any air quality standards to be exceeded or, if a source-related air quality standard is already exceeded in the vicinity of the proposed site. A second evaluation is required after the source is built before it can obtain a permit to operate. This permit procedure will soon be extended to "complex" sources of air pollution - such as freeways and shopping centers, which indirectly cause air pollution by increasing automobile traffic.

3. Bay Area Sewage Services Agency (BASSA)

The Bay Area Sewage Services Agency (BASSA) is a nine-county public entity empowered by the State to prepare and adopt comprehensive water quality management plans for the Bay Region, to participate in the development of water quality standards and requirements prepared by Federal and State agencies, and to review applications for financial assistance for water quality control facilities proposed by subregional agencies. State legislation calls for BASSA adoption of a regional water quality management plan not later than January 1, 1974. The plan, based on regional planning agency (ABAG) and local agency land use development plans, is to include:

- A Facilities Plan, indicating systems of conveyance, treatment, reclamation, and disposal of municipal and industrial wastewaters to meet State policies, plans, and requirements.
- An Implementation Plan, including identification of agency responsibilities for construction and operation of wastewater treatment and disposal facilities, a recommended timetable for implementation of the BASSA plan, and a proposed financial plan, including apportionment of costs.

To date, the Agency Board has adopted an initial 1973 Regional Plan, discussed below, and a Statement of Policy intended to "delineate the policies which will govern BASSA's internal functions and its working relationships with others."

a. 1973 Regional Water Quality Management Plan was adopted by the Agency Board of December 5, 1973, and is intended to satisfy BASSA's legislative mandate until the full regional plan is adopted. The 1973 Plan includes a Facilities Plan as well as identification of agency responsibilities, but does not include a recommended implementation timetable or financial plan. The 1973 Plan is consistent with the conceptual Facilities Plan of the Regional Water Quality Control Board's Interim Basin Plan, which is based on regional water quality protection needs and on the plans by local communities and industries.

Present plans of the East Bay Dischargers are to upgrade to secondary treatment at Alvarado, Hayward, Oro Loma and San Leandro with outfall in San Francisco Bay offshore of Oakland Airport. Present plans are to tie in Livermore-Amador Valley wastewater effluent to the East Bay Discharger line. The existing East Bay Municipal Utilities District treatment plant is being expanded and upgraded to secondary level with design capacity sufficient to adequately handle projected waste flow for the District. The generation and disposal of sludge from these operators are discussed in another section of this plan.

4. Metropolitan Transportation Commission (MTC)

The Metropolitan Transportation Commission (MTC) was created in 1970 by the State Legislature to provide comprehensive regional transportation planning for the San Francisco Bay Region. The Commission assumes planning and related responsibilites of the Bay Area Transportation Study Commission and its interim successor, the Regional Transportation Planning Committee. MTC responsibilities include preparation and maintenance of a Regional Transportation Plan and clearinghouse review of Bay Region transportation projects including:

- Construction of any transbay bridge, including modifications which provide for additional traffic lanes or for rapid transit facilities (except projects funded prior to November, 1970).
- Construction of state highways within the Bay Region, unless there is an overriding statewide interest.
- Local applications for state or federal grants of money if the application contains a transportation element. MTC review is not required for Motor Vehicle Fuel License Tax subventions to local governments.
- Multi-county transit facilities using an exclusive right-of-way (except projects authorized prior to adoption of the Regional Transportation Plan).

Regional Transportation Plan was adopted by the Metropolitan Transportation Commission on June 27, 1973, to fulfill the intent of the State Legislation. As a basis for planning, MTC has used land use proposals of the "Regional Plan 1970-1990," approved by the Association of Bay Area Governments. The Regional Trnasportation Plan includes proposals for a network of transportation arteries connecting residential, commercial, institutional, industrial, and recreational centers of the Bay Region and proposals for major terminals and local support services that feed and connect with the arterial system. Proposed additions to the transportation system are identified as issues of regional significance and are assigned a priority rating. Livermore-Amador Valley transportation issues include:

- Interstate Route 580 Widening, identified as an important inter-regional connection for which growth impacts need by evaluated in conjunction with a BART corridor study now in progress. The project widening is given a high transportation system priority, and project costs are included in the 10-year Capital Improvements Program (C.I.P.)

- BART Extension to the Livermore-Amador Valley: Studies (by the Livermore-Pleasanton BART Extension Board) are underway for this project. The extension is given a high system priority and is recommended for further evaluation. Some costs are included in the 10-year C.I.P., but would not be available from existing sources.
- Express Bus Service from the Hayward BART Station, endorsed by MTC, began in November, 1974, using available and programmed funds.
- Local Bus Service in the Livermore-Pleasanton Area is recognized as a high priority planning issue, for which early implementation is needed. Costs are in the 10-year C.I.P., but new sources are required.

5. San Francisco Bay Area Regional Water Quality Control Board

The San Francisco Bay Area Regional Water Quality Control Board (BARWQCB) is mandated by the State Legislature to:

- Obtain coordinated action in water quality control;
- Encourage and assist in self-policing waste disposal programs;
- Invite state or local agency investigation on technical matters involved in water quality controls;
- Recommend to the State Board projects which the Regional Board considers eligible for any financial assistance;
- Report to the State Board and local health officials any case of suspected water contamination;
- Consider the effects of its actions in relation to provisions of the California Water Plan or any other plan for development, utilization, or conservation of state water resources; and
- Encourage regional planning and action for water quality control.

The Water Quality Control Plan for the San Francisco Bay Basin (Basin 2) was prepared by the staff of the San Francisco Bay Regional Water Quality Control Board with guidance and statewide coordination by the State Water Resources Control Board and its staff. The Plan was adopted by the Regional Board in 1975, to satisfy federal and state requirements for construction programs, and to comply with the Porter-Cologne Water Quality Control Act requirements for water quality control plans.

Major elements of the Water Quality Control Plan are the Bay Wastewaters Facilities Plan, and the Projects List:

The Wastewater Facilities Plan prescribes, in broad terms, subregional sewerage facilities which the Regional Board believes must be constructed to achieve water quality objectives and prohibitions in the Interim Plan.

As is the ease with other agencies, RWQCB is now taking air quality into account in its review of facilities, and will condition approval of future facilities on air quality maintenance criteria. In addition to those duties, RWQCB oversees sewer districts' compliance with state discharge limitations for various sewerage by-products. In this capacity, it has the authority to close or phase out plants, or place freezes on additional connections to existing plants which fail to comply with discharge requirements, as has recently been the case for treatment plants in the Livermore-Amador Valley.

D. Alameda County Policies and Plans

1. Local Agency Formation Commission

In 1963, the California Legislature established a Local Agency Formation Commission (LAFC) for each county in the state. The Alameda County LAFC consists of five members - two county officers representing the County; two city officers representing cities in the County; and one public member appointed by the other four members of LAFC. The functions of the Commission are to review and approve or disapprove, with or without amendment, proposals for incorporation of a new city, creation of a new district, annexation to or exclusion from a city of district, and a variety of changes in organizations of special districts, including dissolutions, consolidations, and mergers of special districts. Decisions by the Commission precede any further actions to be taken in such matters.

Recent amendments to state law require that "to carry out its purposes and responsibilities for planning and shaping the local and orderly development and coordination of local government agencies so as to advantageously provide for present and future needs of the county and its communities, the Local Agency Formation Commission shall develop and determine the sphere of influence for each local government agency within the county." The amended statutes define "sphere of influence" as "a plan for the probable ultimate physical boundaries and service areas of a local government agency." The sphere of influence, after adoption by the LAFC, is to be used by the Commission as a factor in making regular decisions. In compliance with amended state law, the actions of the Alameda County Local Agency Formation Commission have been, to date, approval of "Spheres of Influence - Policies, Guidelines, Criteria and Procedures of Alameda County," and public hearings for the City of Livermore and Livermore Area Recreation and Park Department as a first of a series of hearings which will ultimately encompass the entire County.

Spheres of Influence - Policies, Guidelines, Criteria and Procedures of Alameda County was approved by the Local Agency Formation Commission at its meeting of March 22, 1973. This document establishes priorities on annexations and special district formations, and provides that the "general policy of the Commission, subject to logical exceptions, is that all urban development, whenever reasonable, shall be municipal development."

Spheres of Influence - Policies, Guidelines, Criteria and Procedures of Alameda County (Continued)-
This policy provides that first priority shall be given to annexation to a city, rather than a special district, if both can provide the same services at approximately the same cost of environmental impact; second priority to annexation to a district or a city rather than the formation of a new special district or city; and formation of a new political entity as the last alternative. LAFC's 1973 policy statement also provides that "intensive urban development should not occur outside the established sphere of influence lines, except when a future city is planned, and that "in most cases, all unincorporated areas within the city's sphere of influence, which are generally within reach of essential city services, should be annexed first," and that "areas lacking one or more essential city service or facilities shall be considered for annexation only on an exceptional basis."

To date, LAFCO has approved spheres of influence for Livermore and Pleasanton.

2. Alameda County Planning Function

The California State Planning and Zoning Law requires that each county in the State establish a planning agency whose primary function is development and maintenance of a comprehensive long-term general plan for the physical development of the county. In Alameda County, the planning agency consists of the County Planning Commission and planning staff. The Department serves in an advisory capacity to the County Board of Supervisors, and makes recommendations regarding plans, policy and courses of action involving matters affecting the physical, social, and economic development in the County. The Board of Supervisors adopts policy for the County in the form of the Alameda County General Plan and Plan Elements.

General Plan Program:

County plans, adopted by the Board of Supervisors, include the Alameda County General Plan (1966, amended to 1974), the Scenic Route Element (1966), the Open Space Element (1973), and the Parks and Recreation Element (1958). Work is in progress on the County General Plan Review, the County Economic Study, and the Housing Element. The Conservation Element, the Seismic Safety, Safety, and Noise Elements are in the public hearing process and must be adopted by September 20, 1975.

a. General Plan, County of Alameda, State of California was adopted by the Board of Supervisors on May 26, 1966, and amended to December, 1974. The General Plan is a comprehensive amendment of the Master Plan of the County of Alameda, adopted in 1957, as amended. The General Plan for the Livermore-Amador Valley Planning Unit is shown in this report.

General Plan Policies:

There are five Land Use Objectives in the adopted Alameda County General Plan:

- Urban Development with Amenities
- General Welfare with Individual Choice
- Balance Between Resources and Needs
- Development Integrated with Rest of Bay Area
- Coordinated Public Facilities and Land Use

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General Plan Land Use Principles applicable to the Solid Waste Management Plan are:

- Relate Development Within and Outside the County
- Disperse Business, Commerce, and Industry
- Equate Planning Unit Manufacturing Jobs with Resident Employees
- Retain Open Space
- Relate Land Uses in Appropriate and Sufficient Areas
- Protect Each Use from Adverse Effect of Others
- Separate but Integrated Uses
- Locate Industry on Large Tracts. Related to Transportation and Protected from Conflicting Uses
- Determine Areas by Requirements, Demand, and Relative Advantage
- Preserve Open Space

b. Open Space Element of the Alameda County General Plan, adopted May 3, 1973, includes the following major Open Space principles:

- Recognize Assets of Open Space to the County
- Provide a Coordinated System of Open Space
- Preserve Large Continuous Area of Open Space
- Provide a Variety of Open Space for Specific Open Space Uses

The Open Space Plan should:

- Include Areas of Irreplaceable Natural and Man-made Resources
- Provide Open Space Around Each Community
- Include Existing, Potential, and Depleted Wildlife Habitats
- Natural Resources Within Open Space Areas Should be Permanently Protected
- Coordinate Open Space Plans with General Plans of Other Agencies
- Establish and Implement Maximum Holding Capacity in Relation to Environmental Resources
- Provide Retention of Agricultural Lands in Large Holdings Through Zoning

c. Scenic Route Element of the General Plan was adopted May 5, 1966, and is intended to serve as a guide for establishment of programs and legislation dealing with the development of a system of scenic routes and preservation and enhancement of scenic qualities and natural scenic areas adjacent to, and visible from, scenic routes.

d. The Park and Recreation Element of the General Plan consists of two documents:

- The Recreation Plan, adopted June 12, 1956. The map, entitled "The Recreation Plan" and text section, entitled "Existing and Proposed Recreation Areas" are amended by:
- A Part of the Park and Recreation Element of the General Plan: Principles and Standards for Planning Local Parks and Other Recreation Areas, adopted November 21, 1968.

The Park and Recreation Element Plan is consistent with General Plan major park and recreation area land use proposals and with Scenic Route Element proposals.

Administration and Implementation:

The Planning Department, through its Administration and Implementation program, provides for effectuation of policies established in the General Plan and Plan Elements through the development and maintenance of shorter range, more detailed and localized plans for the unincorporated and related cities, hearing and action upon applications required by the zoning, quarry, and subdivision ordinance. The Planning Director acts on Site Development Review plans, plans for Private Streets and applications for Agricultural Preserves, while the Zoning Administrator acts on Conditional Use Permits and Variances.

The "Alameda County Ordinance Code" contains both zoning and subdivision ordinances of the County. As required by recent State Planning Law amendments, the Planning Department has undertaken a program of comprehensive review of zoning in the unincorporated areas to determine changes necessary for consistency with the County General Plan. Findings of this review will serve as a basis for zoning changes as necessary for consistency with planned land uses.

The "Agricultural Preserve Program" of Alameda, as authorized under the California Land Conservation Act, provides that, under a ten-year, renewable contract between the County and eligible property owners, agricultural lands will be assessed at or near their agricultural productive value, provided these lands remain in agricultural use through the contract period. The Planning Director acts on applications for Agricultural Preserves, which to date total approximately 188,000 acres in the County.

E. City Policies and Plans

E. City Policies and Plans

Each of the thirteen cities in Alameda County has an adopted General Plan. Most of them do not refer directly to solid waste management. The following is a summary of city policies and plans relating to Solid Waste:

Alameda: The Alameda General Plan was adopted in 1968 and has had periodic revisions. The present landfill site is shown for medium density residential with a 100-foot wide shoreline park at the perimeter.

Albany: City Council adopted revised General Plan July 1, 1975. The future use of the existing landfill site, presently being phased out is discussed.

Berkeley: The City of Berkeley is using the adopted 1968 Master Plan which is presently under revision. Although there is no mention of solid waste management in the 1968 plan, the present fill site is shown for recreational use on the plan map.

Emeryville: The recently adopted Emeryville General Plan has no specific mention of Solid Waste Management.

Oakland: Oakland's General Plan originally adopted in 1959 has been amended to 1971. Oakland also has a Policy Plan adopted October 24, 1972, and amended to March, 1975, that includes environmental and water quality concerns that relate to solid waste management planning.

Piedmont: The Piedmont Master Plan was adopted in 1958 and does not include Solid Waste Management Plan considerations.

San Leandro: The San Leandro General Plan was adopted in May, 1971. Although it does not discuss solid waste management planning, the plan map indicates the long-term use of the present landfill site as open space.

Hayward: Hayward's General Policies Plan, adopted in 1971 and amended to 1975, and the adopted Hayward Area Shoreline Policies Plan, indicate present landfill sites as recreation and open space on the plan map.

Newark: Newark's General Plan, adopted in September, 1968, mentions a possible solid waste site in the southeast portion of the City.

Union City: The Union City General Plan, adopted in 1962 and amended to 1972, indicates optional land uses for the Turk Island disposal site.

Fremont: Fremont's General Plan was originally adopted in 1956 and amended to 1969 and indicates the future use of the present landfill site as industrial.

Livermore: The Livermore Plan, originally adopted in December, 1964, and amended to 1975, indicates the present disposal site on the General Plan map.

Pleasanton: The Pleasanton General Plan, adopted on January 27, 1965, is amended to December 12, 1973, and indicates the Pleasanton site as agriculture and the transfer station site as industrial.

VIII. PLAN POLICIES AND IMPLEMENTATION PROGRAM

A. Goals and Objectives[1], Findings, and Policies

I. TO EXAMINE SOLID WASTE MANAGEMENT PRACTICES CURRENTLY EMPLOYED AND TO EVALUATE THESE PRACTICES IN TERMS OF PROJECTED GROWTH FOR THE COUNTY BY:

- EVALUATING AND REPORTING ON COLLECTION AND DISPOSAL METHODS;
- DETERMINING THE RELATIONSHIPS WHICH EXIST BETWEEN CONSUMPTION, PROCESSING, AND GENERATION ACTIVITIES WITH RESPECT TO LAND USE AND DISPOSAL METHODS;

Findings - General

1. With the exception of two municipal operations, waste collection is accomplished by private companies (3) under exclusive contracts with each jurisdiction.

2. Regular collection service in the 16 franchise areas is once per week for residential service with the exception of Livermore. Commercial and industrial collection is made by arrangement.

3. Twelve of the 16 franchises are handled by one company.

4. Collection rates vary widely throughout the County and are set by each city or sanitary district.

5. Existing collection service operations in general are organized on a task-incentive basis using side and rear-end loader trucks. Most of the private industry routes are assigned to 2 - 4-man crews and are based upon dollar revenues generated per route. Municipal systems are organized on a standard 8-hour work day.

6. The costs of collection service to the customer includes the costs of transport and disposal.

7. Present collection systems appear to have high reliability and flexibility.

8. Transport of wastes is accomplished by standard collection vehicles to close-in landfills.

9. Resource recovery at landfills today is limited to ferrous can recovery, and recovery of large ferrous and non-ferrous objects by hand.

10. In general, regulation of land disposal operations by regional, County, and city agencies is not performed consistently.

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[1] Adopted by the Alameda County Solid Waste Management Plan Advisory Committee August 9, 1973.
Revised 8/7/75, 8/14/75

11. While present laws call for safe and efficient land disposal of solid wastes, existing enforcement procedures are not adequate to accomplish the intent of these regulations.

12. Regulatory responsibility is highly fragmented; no single agency is maintaining supervision over activities at the sites in Alameda County. Instead, each public agency concentrates on only one aspect of disposal operations. There is almost no comprehensive monitoring of landfill sites in the County being carried on under one agency or in coordination with concerned agencies.

13. None of the sites presently in operation in the County may be considered sanitary landfills, with one possible exception--the Eastern Alameda County Disposal Site.

14. Problems relating to environmental quality are associated with several of the sites which are close to San Francisco Bay.

15. Operational problems were apparent at most disposal sites in Alameda County in the Fall of 1974.

16. In general, control over the types of materials being dumped is lacking. Few site operators thoroughly inspect incoming materials, and hazardous materials or non-permitted wastes could be covertly deposited at most of the sites.

17. Implementation of a waste processing system which could recover materials and/or energy, along with a centralized waste disposal facility, could begin to resolve the more serious environmental problems associated with uncontrolled landfill disposal of wastes.

<u>Landfill Sites in Alameda County - Policies</u>

Resource Considerations:

1. Land is a valuable natural resource. Any lands designated in the Solid Waste Plan and in the General Plan as being suitable for a disposal site must be subjected to a critical review before approval as a site.

2. Burial of recoverable waste materials is presently more economical but not the most desirable solution to the waste disposal problem. The "out of sight, out of mind" philosophy of waste disposal is invalid in a world of finite resources.

3. Resource recovery systems (focusing on materials recovery and/or energy recovery) could have a very significant impact on the reduction of solid wastes going to landfills and would conserve valuable resources and energy.

4. All solid waste disposal sites should be protected against encroachment of incompatible land uses and should be reclaimed for future use in accord with the General Plan.

Findings - Sewage Treatment Residues

Operational Problems:

1. There is a need to continue and support present systems which are operating to protect the environment and the public health.

2. Costs of disposal of materials through sewage treatment systems are not well defined for the customers; they do not convey the fact that treatment is intermediary to final solids disposal and that treatment costs per ton are very much higher than traditional collection-disposal systems.

3. Planning for safe and adequate solids disposal on a coordinated countywide (or regional) scale is just now beginning.

4. The proliferation of in-sink garbage disposals increases both costs and plant loads tremendously. Few policies are directed at reducing future quamtities of solids ground into the sewer system.

Programming Problems: (Management-Administrative Planning)

1. Plans for plant expansion currently are made in coordination with local-regional disposal plans.

2. Solids disposal and/or reuse is poorly coordinated on an areawide basis at the present time.

3. Although alternatives for disposal and reuse are being studied, only the most preliminary information on cost and environmental effect is available.

4. Disposal methods are currently being studied by various agencies. Opportunities for further R & D must be improved and encouraged.

Development Problems: (Long-Range Planning)

1. Future opportunities for the utilization of sewage treatment residues need to be sought through coordination, operation, planning, and research.

Findings - Food Processing Wastes

1. Waste produced by the food processing industry in Alameda County is of the same magnitude (annual total tonnage) as the quantity of waste produced by heavy manufacturing industries.

2. Meatpacking and dairy products industries produce wastes which are either liquid or reclaimed as by-products and, therefore, do not pose solid waste problems.

Findings - Food Processing Wastes (Continued)

3. Fruit and vegetable processing produces large quantities of solid and semi-solid wastes.

4. The organic waste produced from fruit and vegetable processing is a special waste problem because of its characteristics (high moisture content, putrescibility), its seasonal or irregular production, and the large quantities generated.

5. Approximately 99.6% of the total organic food processing wastes produced in Alameda County are generated by the eight largest fruit and vegetable canners.

6. Organic wet wastes are, for the most part, not disposed in landfills within Alameda County.

7. Local ordinances and permits limit in-county disposal of organic cannery wastes, and a heavy reliance is being placed on continuing out-county disposal.

8. Limited markets seem to exist at the present time for the recovery or reuse of food processing industry wastes.

9. The data presented in the background report on each fruit and vegetable processing plant's waste production was derived from estimates made by plant managers and plant engineers at each location.

10. The majority of the plants surveyed seemed to possess a rudimentary knowledge and understanding of the magnitude of their waste problem.

Policies - Special Wastes

1. Hazardous Wastes - Organic and Inorganic Industrial Wastes, Hospital and Medical Wastes, and Pesticides

   It is recommended that:

   a. interim policies be adopted by the Board of Supervisors for the control of hazardous wastes;

   b. the County waste management agency be assigned the authority for overall management of hazardous wastes;

   c. a full report be made to the Board of Supervisors on the status of hazardous waste handling, generation, and disposal at the earliest possible time and on a periodic basis by the County waste management agency;

   d. any County program for hazardous waste management should be coordinated with State Health Department functions and regulations.

2. Sewage Treatment Residues

It is recommended that:

a. a greater degree of coordination of management and disposal activities, as well as planning, be provided by the County waste management agency and the sewerage agencies in the County.

b. the County waste management agency have the responsibility of informing the community on the costs and problems of disposal of sewage treatment residues;

c. comparative cost information on disposal of wet garbage through traditional can collection and garbage grinder/sewage disposal be made available to the public;

d. full public discussion of alternative disposal methods being developed including composting with solid wastes must be continued.

3. Food Processing Wastes

It is recommended that:

a. the County waste management agency be responsible for regulation and management or coordination of food processing wastes disposal. In coordination with industry, the County waste management agency should explore alternative and productive disposal methods such as composting, methane production, animal feed, and soil conditioning.

b. the agency establish and maintain liaison regionally with solid waste and sewerage agencies handling food processing wastes.

. DETERMINING THE MAGNITUDE OF THE SOLID WASTE DISPOSAL PROBLEM AND RESOURCE RECOVERY POTENTIAL, PRESENT AND FUTURE;

Findings

1. Present estimates set total County waste generation (residential and commercial and industrial) at 1,083,400 tons in 1975.

2. Estimates of waste generation are based upon surveys conducted by Oakland Scavenger Company in 1973, which indicate that per capita generation may be set at 5.1 pounds per day in 1975. A one percent per year growth rate in waste generation is assumed.

3. While estimates show total waste generation arriving at the landfill (Davis Street) excluding demolition wastes, approximate 2.3 pounds per person per day is from residential collection services and the remaining from commercial and industrial sources.

4. The accuracy of estimates of waste generation could be greatly improved by more accurate record keeping and regular weighing of incoming loads.

Findings (Continued)

5. Total materials contained in municipal solid waste and landfilled in 1975 included:

	Tons	Value ($MM)
Ferrous metals	43,300	$0.87
Non-ferrous metals	5,420	1.63
Glass	54,200	1.08
Newspaper	48,800	0.98
Cardboard	119,200	2.38
TOTAL	270,900	$6.94

6. Current technology is able to recover approximately 10 to 20 percent of total municipal wastes and reasonably (at 10 percent) could recover the following fractions today:

	Tons	Value ($MM)
Ferrous metals	41,200	$0.41
Non-ferrous metals	3,790	1.14
Glass	34,700	0.27
Newspaper	4,880	0.05
Cardboard	11,920	0.12
TOTAL	96,400	$1.99

- DETERMINING PRESENT LEGAL CONSTRAINTS AND FUTURE LEGISLATIVE REQUIREMENTS;

Findings - Present Legal Constraints

1. The recent development of State policies, requirements, and Standards for solid waste management must be reviewed and incorporated as they apply to the County solid waste management plan and implementation program.

2. Present legal constraints are vested in (a) city and County ordinances and (b) administrative procedure.

3. Ordinances and procedures may vary among jurisdictions in the County, and many are out-of-date.

4. A uniform procedure and a County-wide ordinance acceptable to all jurisdictions and applicable to all is presently lacking.

5. General information pertinent to the quantities and costs, charges, and rate of return have been adequate for County-wide planning. These, however, need to be developed on a more comprehensive and detailed basis. Any legal barriers to obtaining information which would assist in the engineering of resource or energy recovery systems or the decision-making process must be modified.

Findings - Present Legal Constraints (Continued)

6. While many administrative and operational activities must be carried on by city government (collection franchise negotiations, quality of service, etc.), there would be certain advantages to a County-wide approach and coordination of activities.
   Such activities could include: (a) determining service areas, (b) arbitration of negotiations, (c) development of information systems, (d) evaluation of rate increase requests, and (c) coordination of transfer and processing activities, etc., and many others.

Policies - Present Legal Constraints - The application of a countywide waste management plan will necessitate a modern waste ordinance as well as standards and regulations. The County waste management agency would begin this work immediately; it should also be the repository for all financial and technical data from industry and local government.

Findings - Legislation

1. Significant improvements in solid waste management will not come about without significant changes in public policy as expressed in law - primarily at the Federal level, but at the State level as well.

2. Local measures to improve resource recovery could be of limited significance since they would not apply outside the jurisdiction of the local area.

3. No solid waste management legislation was passed at the Federal level during 1974, and there is evidence of a lack of interest and a lack of leadership in solid waste management matters at the Federal level.

4. Legislation at the State level, after the preliminary surge of SB-5, has been meagre. The Solid Waste Management Board Policies and Resource Recovery Program reflects a similar lack of strong guidance. In addition, the Board pays little attention to local needs and feedback in response to referrals.

Legislative Needs - Policies Recommended

New legislation in solid waste management can probably be most effectively directed towards the following objectives:

1. To reduce the amount of material entering the solid waste stream (source reduction).

2. To maximize recycling, reuse, or other productive application of waste resources (resource recovery).

3. To strengthen the state -area wide- local solid waste management planning and implementation functions through policies and financial assistance programs.

Objective: TO REDUCE THE AMOUNT OF MATERIAL ENTERING THE SOLID WASTE STREAM (SOURCE REDUCTION).

Legislation/Policies Needed:

1. Establish standards for product durability. (Federal level)

2. Discourage specific types of single-use products (such as no-deposit, no-return beverage containers) through prohibitions against their manufacture or sale. (State and Federal as well as local levels).

3. Discourage, in the form of a tax, excessive use of packaging materials or use of single-use items (such as disposable towels, diapers, cups, etc); apply these revenues towards solid waste management and resource recovery programs. (State and Federal levels)

4. Tax regulations should be changed to discourage advertising by junk mail. (Federal level).

5. Government at all levels (Federal, State, regional, local) should promote public eduction programs to develop a "conservation ethic" among the general public.

6. Require that containers be of standard size and shape (Federal).

Objective: TO MAXIMIZE RECYCLING, REUSE, OR OTHER PRODUCTIVE APPLICATION OF WASTE RESOURCES (RESOURCE RECOVERY).

Legislation/Policies Needed:

1. Federal standards should be established for re-usable containers as to size, color, quality, design; consumers should be encouraged to return such containers to retail outlets through a deposit system.

2. Federal standards, regulations, and tax incentives should be established for the percentages of recoverable, reusable, or recyclable materials which shall be contained in specific products in order to promote the substitution of recovered materials for raw resources in manufacturing the product. (Or, maximum permissible quantities of virgin materials in specific products could be established.)

3. Revise the Federal tax code to terminate or modify such measures as depletion allowances and capital gains privileges for virgin timber and mineral producers in order to discourage the rapid consumption of new raw materials and encourage the recovery of waste materials. (Tax equity for secondary materials)

4. Quotas should be placed on production and importation of new paper, and the paper recycling industry should be subsidized to make use of recycled paper products economically attractive to the consumer. (Federal level)

5. Manufactured products could be taxed on the basis of the proportion of new and recovered materials included in their manufacture. (For example, an item made entirely from new substances would be charged the full tax, while one which contains 50 percent recycled components might be charged half of that or perhaps no tax at all.) This type of levy has been termed a "disposal tax." (Federal and State levels)

Legislation/Policies Needed: (Continued)

6. The existing transportation (freight) rate structure - low rates for virgin commodities and high rates for secondary materials - should be revised in order to encourage resource recovery. (State and Federal levels)

7. Governmental agencies should be required to purchase products containing recycled materials. Such procurement policies would support markets for secondary materials.

Objective: TO STRENGTHEN STATE--AREA WIDE--LOCAL SOLID WASTE MANAGEMENT PLANNING AND IMPLEMENTATION FUNCTIONS THROUGH POLICIES AND FINANCIAL ASSISTANCE PROGRAMS.

Legislation/Policies Needed:

1. Federal legislation mandating State solid waste management planning should require consistency with State comprehensive planning as well as recognize the role of regional and county comprehensive planning agencies in the State--area wide--local system.

2. The Federal government needs to provide continuing technical and financial assistance for State, area wide, and local planning efforts.

3. As part of the State--area wide--local planning process, the State should provide for standardization of data gathering (measurement of weights, volumes, types of wastes), recording, and reporting. Also, the State should act as a clearinghouse for information on solid waste management practices and developments in California.

4. The State should recognize that reasonable cost to the householder is a fundamental consideration to local governmental elected officials in selecting a county solid waste management system that is economically feasible and environmentally sound.

5. Coordination among neighboring counties is vital in planning and implementing solid waste management systems.

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6. Financial Assistance to local (regional) governments should be in the form of grants, loan guarantees, or construction grants, (See pg. VIII-18).

- <u>ESTABLISHING CRITERIA FOR THE EVALUATION, HANDLING, AND DISPOSAL OF SOLID WASTES INCLUDING LAND DISPOSAL SITES, MATERIAL HANDLING, AND RESOURCE RECOVERY SYSTEMS.</u>

<u>Findings - Standards and Criteria</u>

1. Comprehensive modern standards for solid waste management are lacking in Alameda County.

2. Present standards are currently administered through a myriad of public agencies.

Findings - Standards and Criteria (Continued)

3. State Solid Waste Board Standards are available and can be used as a basis for development of local standards. (The standards represent a minimum and are advisory).

4. System evaluation criteria developed from the State Solid Waste Board guidelines by F. C. Hurlbut in 1974 are available for comparative evaluation of systems and systems' components.

Findings - Recycling Centers

1. The educational value of community recycling centers exceeds the physical benefits in reducing solid waste disposal problems and preserving natural resources.

2. The participating structure surrounding the recycling centers is a benefit to the community in many more ways than just the quantities of materials recycled.

3. Source separation provides a cleaner/purer product.

4. The differing participatory patterns in Alameda County indicate that, while the potential for source separation is high and can be expanded, there must be a uniform imperative declared at the State and Federal levels to encourage recycling or source separation and reduction.

5. Patterns of participation differed within the County depending upon whether local interests focused upon technical or social solutions or problems.

6. Industry cooperation with community recycling projects is high throughout the County.

7. Public subsidies have been used to support some recycling programs; returns from sales of secondary materials have not been adequate to support the centers.

8. The operation of recycling centers is labor intensive and relies heavily upon a large voluntary labor supply.

9. Materials recovery efficiency would be markedly increased through a more coordinated and widespread application of recycling.

10. Recovery of newsprint, corrugated and aluminum seems to offer the highest potential for initial countywide source separation programs.

Policy Recommendations - Standards and Criteria

1. Implementation of this Plan necessitates:

   a. review and adoption of a modern and uniform waste management ordinance,

   b. acceptance of criteria and standards for evaluation of present and new systems or components,

   c. development of locally applicable operational standards for all aspects of waste management.

Policy Recommendations - Resource Recovery

1. Recycling Centers

   It is recommended that:

   a. the community be encouraged to use local recycling centers to reduce the flow of solid waste and to preserve resources;

   b. recycling centers be assisted by local agencies as a means of reducing the flow of solid waste and as a means of educating the public;

   c. the Federal and State governments provide incentive and leadership in the area of resource recovery by establishing strong policies encouraging such activities, including appropriation of funds for establishment of recycling centers;

   d. recycling centers serve on a permanent basis, or on an interim basis, until the establishment of sub-county resource recovery facilities as part of the solid waste management plan.

2. Scrap Processing Facilities

   It is recommended that:

   a. the community be urged to use local scrap processing centers to reduce the flow of solid waste and to preserve resources.

3. Source Separation

   It is recommended that:

   a. research be undertaken by local agency technical staff and the operators to determine the economic feasibility of source separation.

II. <u>TO EXPLORE PRESENTLY DEVELOPING ALTERNATIVES FOR HANDLING, DISPOSING, AND RECOVERY OF RESOURCES AND ENERGY FROM THE SOLID WASTE STREAM.</u>

<u>Findings -</u>

1. A well developed technology will permit separation of solid municipal wastes into two or more components.

2. Front end systems (material handling and separation) may be used to shred and separate ferrous metals, non-ferrous metals, glass, and organics.

3. Markets for secondary materials fluctuate frequently so that materials recovery costs may just equal or be less than revenues from sales. The sensitivity of costs to markets and user charges needs to be further evaluated.

4. Although many innovations in resource and energy recovery have occurred, conventional collection and disposal will still remain operationally much the same in the future.

5. The organic fraction of the municipal waste stream could be utilized as a component of compost, for supplemental fuel for a boiler, or for recovery of energy through pyrolysis (destructive distillation).

6. The technology of recovery of one or more forms of storable energy (fuel gas, methane, methanol, fuel oil, etc) is currently in the demonstration phase. Markets for the products make this alternative attractive if public financing can be obtained.

7. Although further testing of energy recovery systems needs to be completed before a decision on one system is made, planning can continue towards implementing energy recovery systems.

8. The quantities of waste generated in Alameda County are sufficient to justify the operation of a complete resource recovery facility near Oakland.

9. Because of the rapid and frequent fluctuations in prices for materials recovered from municipal waste, price supports, public ownership of processing facilities, regional materials clearinghouse, materials standards, mandatory garbage separation laws, and local bottle bills need to be evaluated for local impact.

10. An evaluation of the current energy recovery technology by Stanford Research Institute in December 1974, concluded that while incineration was the least costly of Alternatives examined, the Union Carbide Purox pyrolysis process at a slightly higher capital cost could provide more than one form of storable energy and realize credits to offset a significant portion of costs.

Policy Recommendations -

1. The State Solid Waste Board in cooperation with counties should provide continuing research into the development of alternatives for handling, disposing and recovery of resources and energy from the solid waste stream.

2. Alameda County should seek funding to prepare specific plans for developing alternative disposal and recovery methods and financing. A technical group consisting of industry, public, and quasi-public agencies should continue to plan for innovative waste management techniques.

3. If studies determine that any innovative techniques would be economically and environmentally beneficial, pilot projects should be installed to test the feasibility and serve as a model upon which funding needs would be based for full scale operations.

III. TO PRESERVE AND MAINTAIN A HIGH QUALITY ENVIRONMENT BY PRESERVING AIR, WATER, LAND, AND THE COMMUNITY IN A HIGH QUALITY.

Findings -

1. Environmental controls on waste disposal operations are administered through a myriad of agencies at all levels of government, most of which require approval or a permit.

2. The County Health Department enforces the State Health and Safety Code and the County Health Ordinance as it relates to all aspects of waste management. Its operations are virtually countywide; a competent and well trained staff has been actively documenting and resolving problems for years.

3. The County Planning Department acts as a clearinghouse for all environmental and social information on disposal activities in the unincorporated area as do cities in incorporated areas. Through the hearing process, sound operational criteria may be established and enforced.

4. Although little source separation recycling is occurring through established recycling centers throughout the county (less than 1% of total waste), many benefits(resource conservation and energy savings) are realized and could be realized through this method.

5. A modern ordinance and subsequent comprehensive standards and regulations for environmental protection is needed to replace existing antiquated ordinances. Administration of the Plan would be more efficient with the development of the uniform waste management ordinance.

Policy Recommendations -

1. Each city and the County should follow guiding principles in their respective conservation elements in the establishment of any solid waste management site or facility.

2. Every effort should be made to include only environmentally sound solid waste management operations in cooperation with the state, regional and local agencies.

IV. <u>TO ENCOURAGE DEMONSTRATION AND RESEARCH FOR IMPROVING THE TECHNOLOGY OF SOLID WASTE MANAGEMENT INCLUDING THE REDUCTION OF WASTES AT THE SOURCE</u>.

Findings -

1. The largest waste problems in Alameda County are municipal solid waste, industrial wastes, sewage sludge, hazardous, and toxic chemical wastes.

2. New concepts of waste management, which would involve resource recovery and processing or social beliefs and attitudes, are constantly being developed. There is a need within reasonable limits for testing and evaluating new concepts as part of the Plan.

3. Locally, many individuals and public agencies are exploring alternative disposal and recovery methods. One element in the Solid Waste Plan could be financial support and coordination.

<u>Findings - Funding and Financing</u>

1. Special programs (i.e., economic aid) will be needed during the period of transition to an economy which emphasizes resource recovery in order to ease unemployment problems, investment hardships, and other readjustments.

2. The spirit of the "Resources Recovery Act - 1970" has <u>not</u> been pursued by Federal funding programs which would develop and implement solid waste management systems at State and local levels.

3. Federal funding programs for the private sector in developing or implementing alternative disposal methods are also limited.

Findings - Funding and Financing (Continued)

4. Revenue sharing funds to assist local government in developing solid waste management programs do not include capital costs for "hardware."

5. State mandate (SB-5) has provided no funding with which to implement solid waste management planning in California.

   a. Counties are expected to develop and finance solid waste planning alone.

   b. With the exception of the State Water Quality Control Board, there does not appear to be a potential source of funding assistance available to the counties, and resources of WQB are extremely limited.

6. Research, development, implementation of disposal alternatives, and administration of management plans are not currently funded at the state level.

7. The County's options to raise capital to implement a comprehensive plan include combinations of:

   a. General obligation bonds issued at state or local level.

   b. Revenue bonding with joint powers agreements between city-county agencies.

   c. Revenue bonding with revenue sharing funds.

   d. Combination revenue bonding with user charges.

   e. Solid Waste District formation with revenue bonds, ad valorum taxation to finance operation of land-fill sites, if required.

8. Public financing of capital improvements is generally less expensive than private financing due to the tax-exempt status of public organizations and the ability of the public sector to borrow funds at lower interest rates.

9. Neither Federal nor State governments have backed up their designation of local governments - in partnership - with industry as responsible agents for solid waste management and resource recovery planning, construction, operation, and regulation with legislation that provides low-cost financing opportunities for public agencies and private operators.

Findings - Funding and Financing (Continued)

10. There will be a large expense to the local governmental sectors if other methods of solid waste disposal, other than "conventional landfill", are to be employed in a comprehensive program. Implementation of an areawide resource recovery system will require large capital investments, and therefore, extensive capital financing.

Policy Recommendations - Funding and Financing

1. Federal Level

- Financial assistance to combinations of local general purpose governments should take these forms:

  a) grants for research, development, and demonstration programs.

  b) loan guarantees for construction of full-scale operational facilities (Financial markets are reluctant to make municipal loans).

  c) construction grants if no other reasonable means of financing can be found.

- Such assistance should be contingent upon establishment of an intergovernmental mechanism for long range planning and implementation.

- Integration of available technical and financial assistance of all federal agencies whose interests are addressed by a given research and demonstration project should be accomplished.

- Lower the cost of financing facilities for private industry through providing access to pollution control bond money.

2. State (and Regional) Level

- Because solid waste considerations are regional in scope and cannot be isolated within political jurisdictional boundaries, financing of solid waste management systems should be supported at the regional or State level.

- The State should provide technical and financial assistance to areawide research and development programs where multijurisdictional capability has been established.

- State action is needed to provide loan guarantees, low interest loans to local governments for construction of components of a full-scale regional system.

- Profits from resource recovery operations should be shared equitably throughout the community while guaranteeing a fair rate of return to private industry.

2. State and Regional Level (Continued)

- The State should return a portion of tax revenues and other revenues derived from solid waste management activities to the local communities to aid local development and implementation of solid waste management systems.

V. TO ENCOURAGE, ACCOMMODATE, AND INTEGRATE NEW TECHNOLOGY FOR REDUCING THE FLOW OF WASTE MATERIALS IN THE ENVIRONMENT.

Findings -

Solid Waste Processing Facility:

1. There is a greater conservation of resources, including energy, if materials in solid waste are recovered rather than converted to energy.
2. A large geographically limited solid waste processing facility will create adequate accumulations of recovered materials.
3. Adequately served (utilities, transportation) industrial land near the solid waste processing facility will enable greater efficiency in materials recovery.
4. Benefits will naturally accrue if companies and industries and individuals recycle their own products.
5. Use of contracts and materials specifications for recovered materials will have a beneficial stabilizing impact on the recovery of resources.
6. A change in the attitude of the general public toward use of products made from secondary materials will aid in stimulating demand for secondary materials.

Ferrous Metal Recovery

1. There are several ways that scrap iron and steel can be re-used.
2. Transportation is a significant cost in ferrous recovery, and freight rates discriminate against secondary ferrous materials.
3. Existing taxes tend to favor iron ore over scrap as a raw material.
4. Technological constraints would not prevent greater use of scrap.

Non-ferrous Metal Recovery

1. The high value of non-ferrous metals facilitates their recovery.

Non-ferrous Metal Recovery (Continued)

2. Non-ferrous metals recovery is not as sensitive to transportation and location problems as are other materials.

3. Non-ferrous metals are frequently used in small quantities with other materials and are often hard to separate.

4. When aluminum is recycled, there are substantial savings of energy to be realized over production of primary aluminum in both manufacturing and transportation.

5. The scarcity of most non-ferrous metals is causing industry to mine ores out of the country with resulting economic and potential political problems.

Glass Recovery

1. In view of the vast virgin resources and low cullet value, glass recycling appears neither likely to "carry its own weight" nor be of great importance in terms of resource conservation.

2. Use of cullet in glassmaking conserves energy.

3. Transportation is a high cost in glass recovery and some rate discrimination exists.

Newspaper Recovery

1. Source separation of newspaper offers the highest use of this material when compared to the next best alternative, energy recovery.

2. De-inking technology can handle much greater volumes of used newspaper than it currently handles.

3. Factory location and transportation cost are important factors in newspaper recycling.

Corrugated Recovery

1. Source separation of corrugated offers the highest use of this material.

2. Given market stability and reasonable prices, a much greater amount of corrugated could be repulped.

3. Factory location and transportation costs are important factors in corrugated recycling.

Energy Recovery

1. The ability of the energy recovery system or its customers to sustain interruption of either supply or demand for the energy is the important criterion.

2. Separating usable materials from solid waste does not significantly lessen energy recovery potential.

3. Projections of high energy demands should minimize recovery barriers.

Policy Recommendations -

Transfer Stations and Processing Facilities

1. Any solid waste processing facility should be large enough to create an adequate volume of recovered materials and should be located near adequate utilities and roads in order to achieve optimum efficiency in materials recovery. (Economy or Scale)

2. If maximum conservation of resources (including energy) is a primary goal, then materials in solid waste should be recovered through composting rather than converted to energy.

3. Industry and individual companies should be encouraged to recover and reuse their own waste products through legal sanctions.

4. Specific contracts and the development of materials specifications for recycled materials should be encouraged in order to produce a stabilizing impact on materials recovery.

5. The recovery and reuse of scrap iron, steel, and tin should be stimulated through revision of discriminatory freight rates and taxes.

6. The recovery of non-ferrous metals is an important objective of a comprehensive solid waste management system because:

   a. when aluminum is recycled, there are substantial savings of energy to be realized over production of primary aluminum in both manufacturing and transportation;

   b. the present high costs of mining in the United States and ultimate scarcity of of most non-ferrous metals is causing industry to mine ores out of the country with resulting economic and potential political problems;

   c. the high value of non-ferrous metals facilitates their recovery.

7. Because the use of cullet in glass-making conserves energy, glass recycling should be implemented where economically feasible.

8. Newspaper recovery is to be encouraged, as deinking technology can handle large volumes of used newspaper.

9. Repulping of corrugated material should be encouraged, given market stability and reasonable prices.

10. Energy recovery should be intensively studied as an important method of solid waste management because:

    a. separating usable materials from solid waste does not significantly lessen energy recovery potential;

    b. projections of increasingly high energy prices and demands should minimize barriers to funding energy recovery.

    c. traditional sources of energy are in increasingly short supply and at higher prices.

11. Transfer stations should be located at several points throughout the County to minimize haul costs and to provide close-in dumping areas for local residents.

Source Generation

1. Newsprint and corrugated should be source separated in order to obtain their highest use--repulping into other paper products.

2. The feasibility of limiting or banning certain materials that are impossible or costly to recycle, such as bi-metal cans, from the municipal solid waste stream, should be given further study.

Social Environmental Considerations

1. Public information programs should be directed towards informing the public on the benefits of using products containing secondary materials as opposed to continuous depletion of virgin materials.

2. Public and quasi-public agencies should be urged to adopt procurement policies which require maximum feasible use of recycled materials in all supplies purchased. Such procurement policies would stimulate the recovery of recyclable materials.

VI. PARTICIPATION IN REGIONAL PLANNING FOR WASTE MANAGEMENT AS IT RELATES TO THE NEEDS AND GOALS OF THE PEOPLE OF ALAMEDA COUNTY SHOULD BE UNDERTAKEN TO THE EXTENT THAT REGIONAL PLANNING ACHIEVES A MORE EFFICIENT MANAGEMENT OF THE WASTE STREAM.

Findings -

1. There are Class I sites in only two counties in the Bay Area requiring long hauling operations resulting in high costs for disposal.

2. Both individually with two adjacent counties and within a nine county regional group, the Alameda County Planning staff has discussed mutual regional solid waste management concerns which resulted in an identification of, and a need to further study, mutual problems.

3. Alameda County has participated in the Bay Delta Resource Recovery Demonstration Action Committee which has investigated an alternative method of regional solid waste disposal in the form of composting.

4. The Alameda County Solid Waste Management Technical Advisory Committee and Advisory Committee reviewed the Stanford Research Institute Report - Refuse As a Fuel and various implementation reports. These groups also reviewed the Bay Area Council Criteria for Solid Waste Management.

Policy Recommendations -

1. The Environmental Constraints map of Alameda County prepared for the Solid Waste Management Plan should be used to determine if there are any general areas in the County suitable for Class I disposal sites.

2. Counties within the Bay Area should work with the regional government to establish and maintain a regional solid waste educational forum and to formulate and recommend regional solid waste policies to the region, state and to their respective counties.

3. The Alameda County Planning staff and Alameda County Technical Advisory Committee Group should continue to review regional solid waste reports.

VII. TO ESTABLISH POLICIES AND ADOPT A FLEXIBLE AND COORDINATED SOLID WASTE MANAGEMENT PLAN AND PLAN NECESSARY ACTION PROGRAMS FOR THE COUNTY.

Findings -

1. On July 13, 1972 the Governor signed legislation to add Title 7.3 to the Government Code which creates the State Solid Waste Management Board within the Resource Agency which provides that each County prepare and adopt a Solid Waste Management Plan by December 31, 1975.

Policy Recommendation - General Policy

It is recommended that:

1. The County Board of Supervisors appoint an appropriate existing agency, or a new agency, to be the County solid waste management agency in accord with State Legislation.

2. Plan administration be initially assigned to a coordinator and interdisciplinary team of city, sanitary districts, and county agencies.

3. In order to accomplish a uniform and coordinated application of the Countywide Solid Waste Plan, a joint exercise of powers agreement be drafted between the County cities, and sanitary districts within the County.

4. City and county ordinances be revised and updated consistent with principles of best modern practices.

5. Solid Waste Management functions which are best managed by private industry should remain with the industry. All parts of the solid waste system, including materials recovery, energy recovery and disposal, should be evaluated by the County Waste Management Agency to determine if public ownership would be more efficient and less costly than would private operation.

Policy Recommendation - General Policy (Continued)

6. Five year action programs for 1976-2000 should be instituted and can provide milestones for resource management and capital improvements to the system.

7. All Solid Waste Management Plan proposals in the county should be in conformance with the adopted Solid Waste Management Plan.

VIII. TO ACHIEVE A COORDINATED AND EFFECTIVE IMPLEMENTATION OF PLAN POLICIES THROUGH PUBLIC PARTICIPATION AND THE COOPERATION OF GOVERNMENT AND PRIVATE ENTERPRISE.

Findings -

1. The State Solid Waste Management guidelines call for cooperation of government and industry in the preparation of the Solid Waste Management Plan. This was achieved through appointment by the Alameda County Board of Supervisors, of representatives of the Mayors' Conference, industry, citizens and comprehensive Health Planning to the Solid Waste Management Advisory Committee. Staff of local agencies and the industry are represented on the Technical Advisory Committee. These groups were responsible for preparation of the Alameda County Solid Waste Management Plan.

Policy Recommendations -

1. That the Alameda County Solid Waste Management Technical Advisory Committee consisting of members of both public and private agencies continue to function as a means of making recommendations for the implementation and updating of the Solid Waste Management Plan for Alameda County.

IX. TO PROVIDE FOR AN INFORMED AND EDUCATED PUBLIC IN ALL ASPECTS OF WASTE MANAGEMENT.

Findings -

1. Guidelines for State Solid Waste Management Plans call for citizen involvement and participation in the preparation of each County Solid Waste Management Plan.

2. Alameda County has presented background reports on the Solid Waste Management Plan to the Planning Commission, has encouraged newspaper coverage of Solid Waste planning activities, and has invited citizens to attend and participate at meetings concerned with solid waste.

Policy Recommendations -

1. Citizens and citizen organizations should participate in Solid Waste Management Plan hearings and future plan reviews in their respective jurisdictions and at the Board of Supervisors.

2. The Technical Advisory Committee should prepare a citizen involvement plan as part of their implementation program to encourage solid waste planning, resource recovery, and energy saving through the media, in the schools, and through public forums.

Recommended Policies on Litter Management in Alameda County

It is recommended that:

1. Litter be recognized as an aspect of solid waste management because of its chronic and widespread occurrence in the County. It is unsightly, a threat to health and safety, and an impediment to the proper function of storm drains and drainage ditches.

2. Since litter is solid waste material which is improperly disposed, it should be treated as part of the overall solid waste management program.

3. There be further study of the litter problem, including all improperly disposed materials, not just man-made items. It should be investigated under the direction of the agency authorized to implement the County-wide solid waste management plan. It is recommended that the State make funds available for a full assessment of litter control problems and activities, in order to determine the seriousness of the litter problem in Alameda County and the most effective methods of litter control, to aid the development of a County-wide litter control plan.

4. The ideal method of litter control is litter prevention rather than litter pick up. Public education programs, mandatory subscription to the garbage collection service, local container legislation, and public litter receptacles are some of the possible methods of preventing litter which should be examined as part of any County-wide litter program.

5. Because the Oregon Bottle Bill has had a significant and documented effect on controlling litter in the State of Oregon, similar legislation should be adopted either at the State or local level.

6. Existing litter control and clean-up programs should be supported and enforced until a comprehensive study of litter is completed and a County-wide program can be initiated. Public education programs, especially in the schools, should be encouraged and supported by local governments and school districts.

B. Implementation Program

Action Program I - 1976-1980

Element I - Plan Administration

Task - Establishment of County Solid Waste Management Commission as the County Solid Waste Agency.

Task - Assignment of Solid Waste Program Administration on Interim basis to interdisciplinary group of existing city and county agencies and special districts.

Task - Drafting joint exercise of powers agreement for plan implementation recognizing city and County needs and goals and the activities of the Joint Refuse Rate Committee.

Task - Coordination of current administrative functions in cities and County.

Task - Set up technical group for review of existing ordinances and design of model ordinance; review of State Solid Waste Board Standards and revision to apply in Alameda County.

Task - Determine budget requirements and staffing commitments by cities, County, and special districts.

Task - Adoptions of countywide interim standards and regulations for waste management.

Task - Design and adoption of acceptable audit path procedures to accompany the standards and regulations.

Task - Design and implementation of a management information system for waste management activities.

Task - Evaluation of current waste management activities for efficiency and cost.

Task - Develop and submit for review program planning charts for resource recovery and energy recovery facilities. Based upon present estimates of capital requirements develop fund acquisition program.

Alternative[1] 1: State General Obligation Bonds
Alternative 2: State Revenue Bonds
Alternative 3: Local General Obligation Bonds
Alternative 4: Local Revenue Bonds

Task - Development of a contingency plan for labor disputes and natural disasters.

[1]not necessarily in order of priority.
Revised 8/7/75, 8/14/75.

Element 2 - Management/Operations

Task - Waste Collection - to remain in private ownership and operation during 1976-1980 . Existing municipal systems to continue.

Task - Ownership/operation of transfer stations for municipal waste.

Alternative[1] 1: Public Ownership/Private Operation
Alternative 2: Private Ownership/Private Operations
Alternative 3: Public Ownership/Public Operations

Task - Waste Processing and Materials Separation - Implementation of part of resource recovery has been suggested by private industry with no guarantees or confirmed decisions. Public financing and ownership of resource recovery must be evaluated in conjunction with the actitivies of industry.

Task - Resource Recovery -

Short Term - Industry plans may include removal of glass, ferrous cans, and cardboard from waste stream. Resources recovered may approach ten percent. Energy recovery systems being evaluated. Landfill still in operation.

Mid Term - By 1976 or 1977, additional materials recovery systems will have been subjected to state-of-the-art review locally and rational choices can be made as to equipment to add and public/private financing possibilities. This could account for nearly 20% resource recovery. Refinements in full scale energy recovery system (such as Purox) will allow go/no go decision.

Long Range - By 1980 and 1985, resources and energy recovery systems may account for from 67% to 87% recovery - combined with astute resource management policies (packaging controls, bottle bills, and source separation programs) waste to landfills may be significantly reduced.

Task - Determine appropriate location of transfer station.

[1]not necessarily in order of priority.

Element 3 - Legal and Legislative

Task - City and county counsel to review draft model ordinance for adoption.

Task - Review of concept of countywide Litter Control and Bottle Bill.

Task - Establish a program of legislative review; identify problems which must be addressed and resolved by changes in State and Federal policies.

Task - Determine legislation needed and recommend same to State.

Element 4 - Finance

Task - Evaluate the revenues generated through user charges and the rates charged in each jurisdiction.

Task - Establish and adopt audit procedures in conjunction with Price Waterhouse Refuse Rate Study and the Joint Refuse Rate Committee.

Task - Determine suitability and adopt model agreement for refuse collection (in coordination with the Joint Refuse Rate Committee).

Task - Determine franchise return fee to be allocated to joint city/county agency to off-set expenses of plan implementation.

Element 5 - Regional Coordination

Task - Continue liaison with State-County regional waste management plan committee through ABAG and discuss common problem areas such as:

- landfill capacity(s)
- hazardous wastes
- import and export questions
- resource recovery potential
- source reduction

Task - Evaluate the common problem areas and coordinate with Santa Clara and Contra Costa Counties.

Task - Participate in regional study of Class I Disposal sites in coordination with ABAG, State Health, Solid Waste Board, and other State agencies.

Element 6 - Public Information

Task - Provide information to public on County-wide Waste Management Plan (Plan Summary).

Task - Develop information packet on recycling centers and other relevant projects.

Task - In coordination with local ecology centers, develop full media package; also evaluate the school education project for application in other communities.

Task - Provide a speakers' bureau available to the community.

Element 7 - Research and Planning

Task - Establish plan review program for updating plan every three years.

Task - Monitor resource and energy recovery demonstrations and integrate new technology into the Plan.

Task - Determine funding requirements for resource and energy recovery projects.

Task - Prepare proposals for funding capital projects, research projects, and demonstration projects.

Task - Evaluate resource recovery potential within each jurisdiction for feasibility of planned resource recovery. Evaluation factors to be considered:

- volumes (current and projected)
- quantities and characteristics
- source separation
- separate collections
- materials, standards and markets

DRAFT

IX. ENVIRONMENTAL IMPACT REPORT

A. Introduction:

The proposed Alameda County Solid Waste Management Plan will not have a significant detrimental effect on the natural and social environments in the County and the Bay Area. The draft Plan was developed in accordance with the mandates of SB-5 and in coordination with cities, special districts, and the industry. Changes to the existing system are required by SB-5 and the proposed Plan policies.

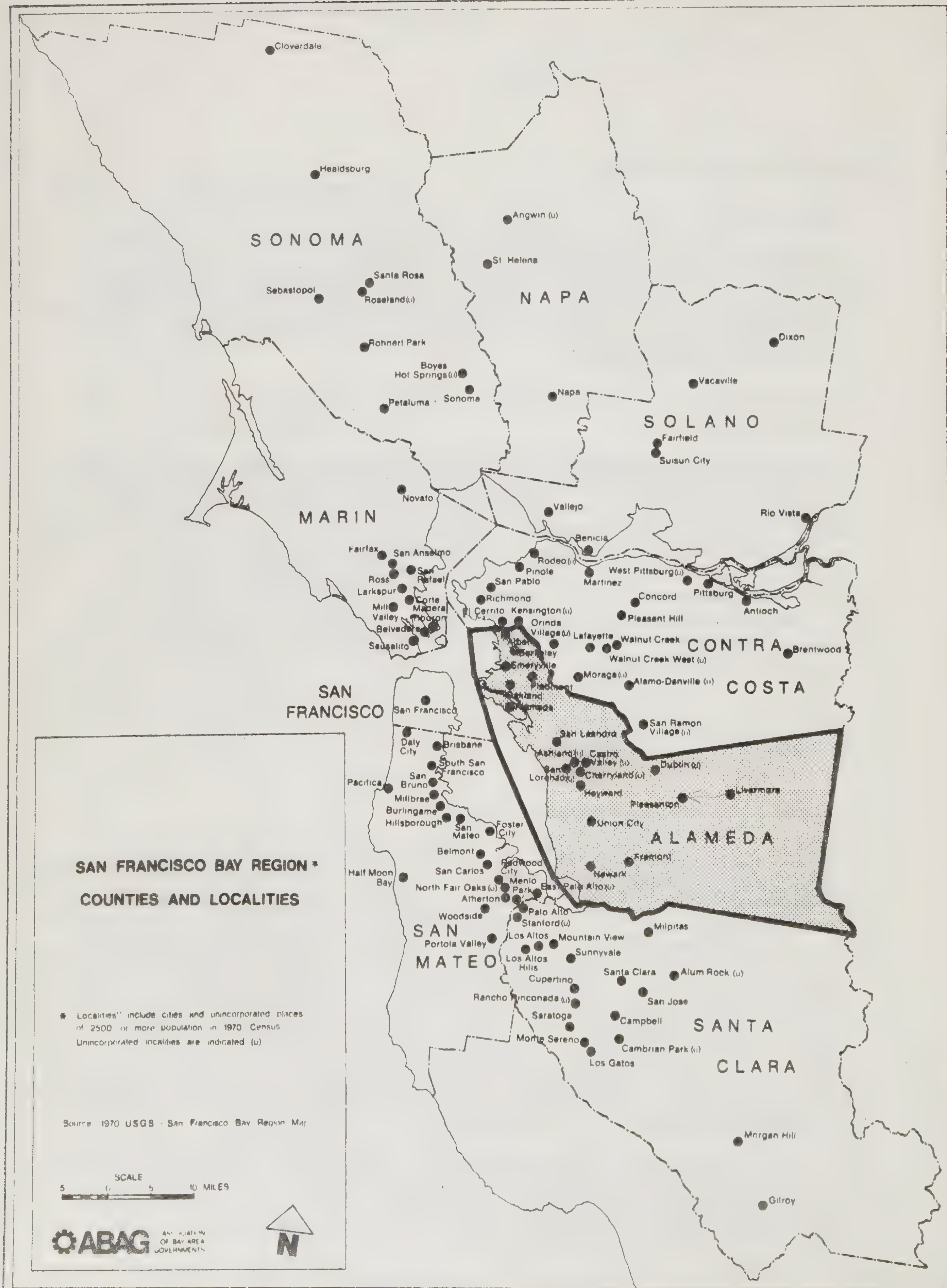
B. Project Description:

The Solid Waste Management Plan for Alameda County is composed of (a) policies regarding the functions and components of a comprehensive, coordinated solid waste management system, and (b) an implementation program for the short and long terms. It is not a project plan which identifies specific new sites for solid waste processing, resource recovery, and/or disposal. It is concerned with solid waste storage, collection, processing, transport, resource recovery, and disposal; it also addresses the implementation functions of plan administration, management/operations, legal and legislative tasks, finance, regional coordination, and public information. A complete description of the entire Plan is presented in Section I. The precise location of Alameda County, the project area, is delineated on several maps in the text of the plan. The text also discusses the technical, economic, and environmental characteristics of each aspect of the proposed solid waste system, including alternative methods, in Sections II, III, IV, V, and VI.

C. Description of the Environmental Setting:

Alameda County, with 13 cities, 735 square miles of land, and 77 square miles of water, is one of the Bay Area's rapidly growing and diverse counties. Geographically, the County consists of a 36-mile-long coastal plain that varies in width from 3 miles at the northern end to 8 miles at the southern end. The East Bay Hills, rising to elevations of 3,000 feet, divide the coastal plain from the Livermore-Amador Valley, a bowl-shaped area surrounded by gently rolling hills of the Diablo Range. Elevations range from sea level to 3,807 feet in the mountainous area in the southeastern portion of the County. Several geologic faults exist, and there are seven different soil types represented throughout. Vegetation varies from coastal salt marsh to green sclerophyll forest to semi-arid and arid grassland. Alameda County represents an area of California noted for its plant endemism, and there are at least twelve rare or endangered species of plants within its boundaries.

The County is divided into two geographical units by the foothills east of the cities of Berkeley, Oakland, Hayward, and Fremont. The Livermore Valley is connected to the coastal plain by three passes: Dublin Canyon, Niles Canyon, and Mission Pass. The Livermore Valley constitutes the


SAN FRANCISCO BAY REGION *
COUNTIES AND LOCALITIES
* Localities include cities and unincorporated places of 2500 or more population in 1970 Census. Unincorporated localities are indicated (u)
Source: 1970 USGS - San Francisco Bay Region Map
SCALE
5 0 5 10 MILES
ABAG
N
SONOMA
NAPA
SOLANO
MARIN
CONTRA COSTA
SAN FRANCISCO
SAN MATEO
ALAMEDA
SANTA CLARA
Cloverdale
Healdsburg
Santa Rosa
Sebastopol
Roseland (u)
Rohnert Park
Boyes Hot Springs (u)
Sonoma
Petaluma
Angwin (u)
St Helena
Napa
Dixon
Vacaville
Fairfield
Suisun City
Rio Vista
Novato
Vallejo
Benicia
Fairfax
San Anselmo
San Rafael
Ross
Larkspur
Corte Madera
Mill Valley
Tiburon
Belvedere
Sausalito
Rodeo (u)
Pinole
Martinez
West Pittsburg (u)
Pittsburg
Antioch
San Pablo
Richmond
El Cerrito
Kensington (u)
Orinda Village (u)
Concord
Pleasant Hill
Lafayette
Walnut Creek
Walnut Creek West (u)
Brentwood
Moraga (u)
Alamo-Danville (u)
San Ramon Village (u)
San Francisco
Daly City
Brisbane
South San Francisco
San Bruno
Pacifica
Millbrae
Burlingame
Hillsborough
San Mateo
Foster City
Belmont
San Carlos
Redwood City
Half Moon Bay
North Fair Oaks (u)
Menlo Park
Atherton
East Palo Alto (u)
Palo Alto
Stanford (u)
Woodside
Portola Valley
Los Altos
Los Altos Hills
Mountain View
Sunnyvale
Milpitas
Cupertino
Santa Clara
Alum Rock (u)
San Jose
Rancho Rinconada (u)
Saratoga
Campbell
Monte Sereno
Cambrian Park (u)
Los Gatos
Morgan Hill
Gilroy
San Leandro
Castro Valley (u)
Cherryland (u)
Hayward
Dublin (u)
Pleasanton
Livermore
Union City
Fremont
Newark

eastern portion of the County, has a small but rapidly growing population, and still supports a significant amount of agricultural activity. While the major portion of population and urbanization occurs in the northern cities of Alameda County, the fastest growth is in the southwestern portion of the County, from San Leandro to Fremont. Rapid population increases have also been occurring in the Livermore-Amador Valley.

Alameda County had a January, 1975, estimated total population of 1,142,000 people distributed within four Planning Units. The Central Metropolitan Planning Unit includes the cities of Albany, Berkeley, Piedmont, Oakland, and Emeryville, with an estimated January, 1975, population of 576,000 people representing 50.5 percent of the total population of the County. It includes 51,030 acres of land. South of the Central Metropolitan Planning Unit, and west of the hills that separate the western portion of the County from the Livermore-Amador Valley, are the Eden and Washington Planning Units.

Eden Planning Unit includes the cities and unincorporated areas of Hayward, San Leandro, Castro Valley, San Lorenzo, and Rural Recreation Areas 1 and 2. The area has an estimated January, 1975, population of 276,100 people, representing 24.2 percent of the population of the County. Eden Planning Unit encompasses 76,430 acres of land.

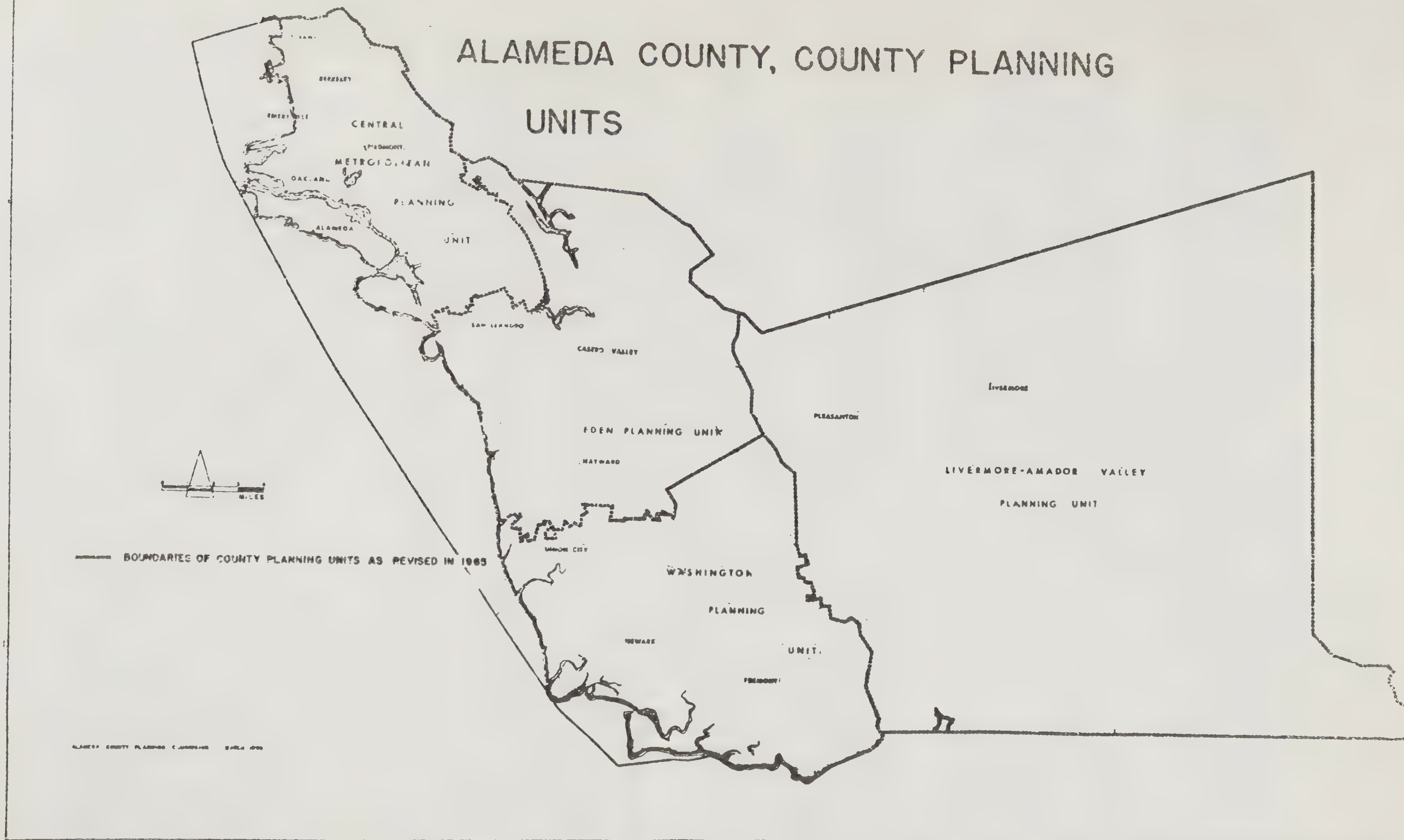
Washington Planning Unit, which includes the cities of Fremont, Newark, and Union City, and Rural Recreation Area 3, has an estimated January, 1975, population of 182,900 people, representing 16.0 percent of the population of the County. Washington Planning Unit has a total of 79,280 acres.

The Livermore-Amador Valley Planning Unit encompasses the eastern portion of the County, and includes the cities of Livermore and Pleasanton, and unincorporated areas of Dublin, Sunol, and Rural Recreation Areas 4 and 5. This valley is 264,530 acres in size and has an estimated January, 1975, population of 106,400 people, representing 9.3 percent of the population of the County. Each of these four planning units is characterized by unique natural features. Land use types, population composition, and characteristics vary in each of the four areas.

A thorough description of the natural environment and its constraints for solid waste management is presented in Sections III and IV.

D. Regional Coordination:

All of the counties in the San Francisco Bay Area are in the process of preparing solid waste management plans; and Alameda County has been in communication with its neighboring counties--Santa Clara and Contra Costa--to discuss solid waste plan coordination and future subregional solid waste management options. Energy recovery, composting demonstration, agricultural land reclamation (sewage sludge and composted municipal waste), and remote landfill are concepts which have been discussed in the development of the Solid Waste Management Plan. Since much of this investigation has been of a research or feasibility study nature and is also very preliminary, a detailed discussion of related impacts would be premature at this time.


ALAMEDA COUNTY, COUNTY PLANNING
UNITS
CENTRAL
METROPOLITAN
PLANNING
UNIT
OAKLAND
ALAMEDA
EDEN PLANNING UNIT
CASTRO VALLEY
HAYWARD
UNION CITY
WASHINGTON
PLANNING
UNIT
NEWARK
FREMONT
PLEASANTON
LIVERMORE
LIVERMORE-AMADOR VALLEY
PLANNING UNIT
MILES
BOUNDARIES OF COUNTY PLANNING UNITS AS REVISED IN 1965

E. Legal, Policy, or Institutional Constraints:

The existing legal and institutional environments in Alameda County will present constraints on plan implementation; and existing policies promulgated by Federal, State, regional, and local governmental agencies will affect both short- and long-term solid waste management programs. Existing policies and regulations relating to the proposed Solid Waste Management Plan are covered in Section VII. The County-wide Solid Waste Management Plan is a identify comprehensive plan for the entire County including the cities, sanitary districts, and unincorporated communities affecting the public and private sectors. The SB-5 mandate will require a change in some existing institutions and policies.

The Plan is to be adopted by a majority of the cities having a majority of the population. Thus, plan implementation is to occur with the majority's approval.

The implementation of the Alameda County Solid Waste Management Plan will be influenced by the following constraints:

- County ordinances apply only to the unincorporated area.
- Sixteen separate jurisdictions are presently responsible for the provision of collection and disposal service to County residents and commercial establishments.
- Local ordinances may seek to restrict use of facilities, such as disposal sites, to certain County residents or may require that a facility be located within a specific number of miles from the city boundaries. Such parochial restrictions are contrary to a coordinated County Solid Waste Management Plan.
- and programs
  State regulations, policies, and programs delineate minimum standards and criteria for solid waste management, and the County's Solid Waste Management Plan must be consistent with these.
- Solid waste management may not be considered a high priority public service by many local jurisdictions. The "out-of-sight, out-of-mind" philosophy prevails in some communities.
- Refuse collection and disposal is dominated by the private sector in Alameda County.
- A majority of the franchises (12) are held by one company.
- There is an apparent reluctance towards public financing of solid waste facilities.
- There is no central coordinating agency for environmental, health, and engineering problems of the solid waste system in Alameda County with the authority to act for, and in behalf of, all of the jurisdictions (16) responsible for solid waste services.

- There is an established practice to pay for solid waste management through user charges (directly) and property taxes (indirectly).

- There is the tendency towards decentralization of solid waste management activities which would not promote well-coordinated implementation of the ~~Plan.~~ resource recovery system &

- Not all aspects of solid waste management can be controlled at the local level. Hazardous waste transport and disposal are examples.

- The private sector has usually been reluctant to reveal cost/revenue data on their operations in Alameda County.

- Each jurisdiction establishes collection rates chargeable to customers in its area. The rate review and franchise negotiation procedure is presently a function of each jurisdiction despite the establishment of the Joint Refuse Rate Committee.

- An adequate comprehensive, updated data base on the solid waste management system in Alameda County is lacking.

F. Environmental Impact:

The overall goal of the Solid Waste Management Plan is the provision of an environmentally safe, efficient, and economical solid waste system to County residences, businesses, institutions, and industries while, at the same time, decreasing the quantity of materials in the waste stream through resource recovery and source reduction efforts. It seeks to promote the conservation of resources and the minimization of adverse impacts on the natural and social environments. Consequently, the Solid Waste Plan is anticipated to have a significant beneficial impact over the long term when full resource recovery is achieved and implementation mechanisms are functioning smoothly.

The environmental impact of the proposed Plan during the short term (present to 1980) will depend on the changes which will be integrated into the present system such as resource or energy recovery and new or centralized landfill operations, new legislation (such as container bills to reduce litter and encourage use of returnable/reusable containers, local ordinances prescribing standards for solid waste facilities, and joint powers agreements), and through construction of facilities for transfer, processing, recovery, and disposal of wastes. Financial impacts are inevitable, because local governments will increasingly participate in solid waste management largely through personnel time commitments, franchise review procedures, monitoring and enforcement activities, and public information, etc. A secondary impact of some changes in the waste system might be added costs to the residential and commercial customers. However, waste system evaluations scheduled in the Implementation Program may reveal areas of substantial cost savings. Social impacts in the short term are minimal; concepts such as source separation and recycling, source reduction, and change in consumer habits, which could reduce the quantities of wastes generated by residents and businesses, signal mid- and long-term

community impacts. In terms of environmental or natural resources, a degree of conservation will be achieved through voluntary recycling efforts, materials separation/recovery, and the greater utilization of recycled products.

1. Adverse Environmental Effects

Any adverse environmental effects will be related to the seven elements of Action Program I - 1976-1980. Each element of the program deals with a different but related aspect of waste management. Some elements of the program may have no impact or, for the short and long range, may have impacts that are obscure and will be dealt with in separate project EIR's.

Element 1 - Plan Administration. No adverse impacts. Establishment and acceptance of standards and regulations on operational aspects of solid waste management would be expected to have a beneficial impact through improving operations and preventing land, air, and water pollution.

Element 2 - Management Operations. In general, minimal adverse impacts are anticipated; these would be associated with only ten percent resource recovery being achieved and with continued landfill disposal in the short term. Cooperation between government and industry should foster beneficial impacts with minimal environmental disruption.

Element 3 - Legal and Legislative. No adverse impacts. New ordinances and regulations would have beneficial impacts by reducing litter and promoting environmental controls on operations. public / private

Element 4 - Finance. No adverse impacts ascertainable at this time. Plan implementation will seek to balance system financial costs with social and environmental benefits.

Element 5 - Regional Coordination. No adverse impacts. The flow of solid waste does not respect jurisdictional boundaries; hence, coordination on common problem areas can lead to system efficiencies and greater control over system operations, especially with hazardous wastes and resouce recovery facilities, for example.

Element 6 - Public Information. No adverse impacts other than the proliferation of printed material which eventually enters the solid waste stream. Otherwise, public education programs would not have adverse environmental impacts. The educational benefit of the printed literature should lead to a reduction of Solid Waste, thus mitigating the effects of the printed material.

Element 7 - Research and Planning. No adverse impacts.

2. Mitigation Measures to Minimize Adverse Impacts

The County-wide Solid Waste Management Plan does not recommend specific sites for facilities. Consequently, until such facilities are designed and submitted to local government for approval, it is premature to discuss mitigation measures. During plan implementation when facility plans are reviewed, measures to reduce any adverse impacts ~~can~~ will be required.

In general, the Plan attempts to reduce significant environmentally adverse impacts traditionally associated with solid waste handling and disposal: air pollution, water pollution, vector problems, and wasting of material resources. Mitigation measures include the reduction of the number of landfill sites, materials recovery through voluntary recycling, source separation and front-end separation, comprehensive regulation and monitoring of all aspects of the system, continuing solid waste planning functions at the County-wide level with the participation of the local jurisdictions and private industry, and eventually full-scale resource recovery including energy recovery.

3. Alternatives

Section V of the Plan, "Evaluation of Solid Waste Management Technology," includes the solid waste management system flow charts depicting alternative systems for handling Alameda County's solid wastes in succeeding planning periods -- 1976 to 1980, 1981 to 1990.[1] (See pages V-40 to V-47.) The estimated annual operating costs for these alternatives is diagrammed on pages VI-32 to VI-39.

In the short-term planning period, Alternatives 1980-A and 1980-C are similar in that both achieve 67 percent resource recovery of wastes generated in the County as a whole. Both alternatives include the following activities: collection, transfer, materials recovery, energy recovery, long-haul transportation, and disposal. The difference is that the 1980-A Alternative depicts the San Francisco Bay Delta Resource Recovery Demonstration Project in operation, utilizing a portion of the City of Berkeley's waste. These two proposed alternatives exceed the State Solid Waste Management Board's criteria for 25 percent resource recovery, and they begin to meet the Plan's goal of maximum resource recovery with minimum waste disposal. Alternative 1980-B is much less successful in achieving the goals of the Plan and the State Solid Waste Management Board. It differs from 1980-A and 1980-C in that energy recovery is excluded. Only seven percent resource recovery is achieved on a County-wide basis.

In the long-term planning period, Alternative 1990-A (full-scale Bay Delta system) achieves 41 percent resource recovery. Because of the existing difficulties in implementing the demonstration project and the low percentage of recovered materials, in comparison with the other alternatives, 1990-A does not appear to be the most feasible alternative. The other three alternatives consist of the same functions (collection, transfer, materials recovery, energy recovery, long-haul transport, and

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[1] Policy recommendations for 1990-2000 included in Section VIII.

amount generated in order to be consistent with Plan Policies. Proposals for resource recovery facilities can be evaluated in terms of energy consumption when presented to the County.

ORGANIZATIONS AND PERSONS CONSULTED:

Solid Waste Management Plan Advisory Committee

- Board of Supervisors:

Sara Conner
Chuck Corica, Vice-Chairman
Walter I. Dahl
Clifford Heisterberg
Franklin Hurlbut
Gus Levy
Albert C. Massa
Carl Olsen
Ariel Parkinson
W. L. Williams

- Comprehensive Health Planning Council:

Lois Hill
W. Wilson Sampson, Ph.D.
Hiram Wolch, Ph.D., Chairman

- Mayors' Conference:

Wallace Fox
William Herlihy
Fred Maggiora
Donald G. Miller
Gail Steele

- Industry:

Ed DePaoli
Lee Hertzberg
Leroy Martin
Lou Schmitz/Tom Meichtry
Gary Schnitzer

Solid Waste Management Plan Technical Advisory Committee

- County Planning Staff:

William H. Fraley, Planning Director
Betty Croly, Asst. Planning Director
Ron Eggers, Planner III
Susan Hootkins, Planner II
Steve Richards, Planner II
Lynne Vanlandingham, Recording Secretary

- County Environmental Health Planning:

Gerald Winn

- County Public Works:

Paul Lanferman
Steve Marsden
Jessie Cambra

- City Managers/Administrators:

Bob Guletz, Albany

- City Planning Departments:

Bill Duval, Berkeley
Doug Eads, Fremont
Ken Ahlquist, Hayward
Charles Cashmark, Newark
Marc Herbert, Oakland, Chairman
Martin Vitz, San Leandro

ORGANIZATIONS AND PERSONS CONSULTED (Continued):

Solid Waste Management Plan Technical Advisory Committee (Continued)

- City Public Works Departments:

  Jerry Eichelberger, Alameda, Vice-Chairman
  A. H. Anderson, Albany
  Richard Gazlay, Berkeley
  Edward Steffani, Emeryville
  Larry Milnes, Fremont
  Gerald Gifford, Hayward
  Randy Werner, Livermore
  Ralph Williams, Oakland
  Robert Bauer, Piedmont
  John Bowling, Pleasanton
  Bob Lawrence, San Leandro
  Ralph E. Kirkup, Union City

- Berkeley Health Department:

  Martin Gerber

- Valley Community Services District:

  Douglas Nelson

- East Bay Municipal Utility District:

  John Larson

- Pacific Gas and Electric Company:

  Leo Thomason

- Association of Bay Area Governments:

  Yvonne San Jule

- Oakland Scavenger Company:

  Lou Schmitz
  Tom Meichtry

- State Health Department:

  Earl Mortenson

- Oro Loma Sanitary District:

  Neil Long

- State Department of Water Resources:

  David M. Hill

- U. S. Soil Conservation Service:

  Denis Nickel (1973-74), Bob Roan (1975)

- Water Quality Control Board:

  Harold Singer

APPENDIX
EIR REFERRAL LIST

Alameda County Officials

Board of Supervisors
1221 Oak Street
Oakland, CA 94612

Planning Commission
399 Elmhurst Street
Hayward, CA 94544

Solid Waste Management Plan
Advisory Committee*
c/o H. Wolch, Chairman

Airport Land Use Commission
399 Elmhurst Street
Hayward, CA 94544

Parks Advisory Commission
399 Elmhurst Street
Hayward, CA 94544

Sand and Gravel Committee
c/o Pleasanton Planning Director
200 Bernal Avenue
Pleasanton, CA 94566

Development Planning Division
399 Elmhurst Street
Hayward, CA 94544

Zoning Administrator
399 Elmhurst Street
Hayward, CA 94544

Local Agency Formation Commission
Roland Mayne
County Administrator's Office
1221 Oak Street
Oakland, CA 94612

Road Department
Public Works Agency
399 Elmhurst Street
Hayward, CA 94544

Flood Control
Public Works Agency
399 Elmhurst Street
Hayward, CA 94544

Alameda County Officials

Building Official
Public Works Agency
399 Elmhurst Street
Hayward, CA 94544

Health Care Services Agency
Environmental Services
499 - 5th Street
Oakland, CA 94607

Sheriff's Department
Room 104, Court House
1225 Fallon Street
Oakland, CA 94612

Agricultural Commissioner
Room 207
224 West Winton Avenue
Hayward, CA 94544

Alameda County Comprehensive
Health Planning Council
499 - 5th Street
Oakland, CA 94607

Office of Emergency Services
2700 Fairmont Drive
San Leandro, CA 94578

Cities and Local Districts

Alameda City Manager
City Hall, Room 135
Santa Clara and Oak Streets
Alameda, CA 94501

Albany City Manager
City Hall
1000 San Pablo Avenue
Albany, CA 94706

Berkeley City Manager
City Hall
Allston Way and Grove
Berkeley, CA 94700

*See list on previous pages.

Cities and Local Districts (Continued)

Emeryville City Manager
City Hall
2449 Powell Street
Emeryville, CA 94608

Fremont City Manager
City Hall
39700 Civic Center Drive
Fremont, CA 94536

Hayward City Manager
City Hall
22300 Foothill Boulevard
Hayward, CA 94541

Livermore City Manager
City Hall
2250 First Street
Livermore, CA 94550

Newark City Manager
City Hall
27101 Newark Boulevard
Newark, CA 94560

Oakland City Manager
City Hall
14th and Washington Streets
Oakland, CA 94612

Piedmont City Manager
City Hall
120 Vista Avenue
Piedmont, CA 94611

Pleasanton City Manager
City Hall
200 Bernal Avenue
Pleasanton, CA 94566

San Leandro City Manager
City Hall
835 East 14th Street
San Leandro, CA 94577

Union City City Manager
City Hall
1154 Whipple Road
Union City, CA 94587

Cities and Local Districts (Continued)

Valley Community Services District
General Manager
7051 Dublin Boulevard
Dublin, CA 94566

Oro Loma Sanitary District
General Manager
P. O. Box 95
San Lorenzo, CA 94588

Castro Valley Sanitary District
General Manager
21040 Marshall Street
Castro Valley, CA 94546

Joint Refuse Rate Committee
c/o Jennings Smith
Oakland City Hall
14th and Washington Streets
Oakland, CA 94612

Solid Waste Management Plan
Technical Advisory Committee*
c/o M. Herbert, Chairman

Alameda County Sewerage Advisory Committee
c/o Oro Loma Sanitary District
Gail Stanton
P. O. Box 95
San Lorenzo, CA 94588

East Bay Municipal Utility District
P. O. Box 24055
Oakland, CA 94623

Airports

Port of Oakland
66 Jack London Square
Oakland, CA 94607

Airport Manager
Hayward Airport
20301 Skywest Drive
Hayward, CA

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* See list on previous pages.

Airports (Continued)

Commanding Officer
Alameda Naval Air Station
Main and Atlantic Streets
Alameda, CA 94501

Airport Manager
Livermore Airport
City Hall
2250 First Street
Livermore, CA 94550

Federal, State, Regional

State Clearinghouse
Office of the Governor
Office of Planning and Research
1400 - 10th Street
Sacramento, CA 95814

State Solid Waste Management Board
Room 1335, Resources Building
1416 Ninth Street
Sacramento, CA 95814

Department of Transportation
T. R. Lammers
Rincon Annex
San Francisco, CA 94119

Air Resources Board
1025 "P" Street
Sacramento, CA 95814

Air Resources Board
William Lockett
Chief Evaluation and Planning
1025 "P" Street
Sacramento, CA 95814

Department of Agriculture
State Board of Agriculture
1220 North Street, Room 111
Sacramento, CA 95814

Mr. Ron Brill
San Francisco Bay Area Council
348 World Trade Center
San Francisco, CA 94111

Federal, State, Regional (Continued)

Department of Water Resources
1416 - 9th Street
Sacramento, CA 95814

Division of Mines and Geology
Ferry Building
San Francisco, CA

Resource Conservation District
P. O. Box 672
Livermore, CA 94550

California Department of Transportation
Division of Aeronautics
Sacramento Executive Airport
Sacramento, CA 95822

Contra Costa County Planning Department
County Office Building
Martinez, CA

Santa Clara County Planning Department
County Administration Building
70 West Hedding
San Jose, CA

Association of Bay Area Governments
Hotel Claremont
Berkeley, CA 94705

Metropolitan Transportation Commission
Hotel Claremont
Berkeley, CA 94705

Bay Area Sewage Services Agency
Hotel Claremont
Berkeley, CA 94705

Bay Area Rapid Transit District
800 Madison Street
Oakland, CA

East Bay Regional Park District
11500 Skyline Boulevard
Oakland, CA

Bay Area Air Pollution Control District
939 Ellis Street
San Francisco, CA 94109

Federal, State, Regional (Continued)

Bay Conservation & Development Commission
30 Van Ness Avenue
San Francisco, CA

Water Quality Control Board
1111 Jackson Street, Room 6040
Oakland, CA

Other

Pacific Gas and Electric Company
24300 Clawiter Road
Hayward, CA

Audubon Society
c/o William Hurd
2754 Olive Avenue
Fremont, CA

Alameda County Farm Bureau
638 Enos Way
Livermore, CA 94550

Sierra Club
5608 College
Oakland, CA 94618

Livermore League of Women Voters
P. O. Box 702
Livermore, CA 94550

Berkeley League of Women Voters
1836 University Avenue
Berkeley, CA

Oakland League of Women Voters
Montgomery Ward Building
Oakland, CA

San Leandro League of Women Voters
1516 Regent Drive
San Leandro, CA 94577

Bay Area League of Women Voters
Claremont Hotel
Berkeley, CA 94705

Other (Continued)

League of Women Voters - Richmond Area
11275 San Pablo Avenue
El Cerrito, CA

Fremont League of Women Voters
P. O. Box 447
Fremont, CA 94536

Hayward League of Women Voters
4346 Edwards Lane
Castro Valley, CA 94546

Berkeley Recycling Collective
Sacramento and University
Berkeley, CA

Ananda Marga Center
Grove and Dwight Way
Berkeley, CA

Third World Recycling Center
2366 San Pablo
Berkeley, CA

Eden Area YMCA
24718 Mission Boulevard
Hayward, CA

San Leandro Ecology Center
1190 Davis Street
San Leandro, CA 94577

Kaiser Aluminum Can-Do Program
Ms. Gerri Rose
Kaiser Center, Room 2052, KB
300 Lakeside Drive
Oakland, CA 94643

Livermore Recycling Center
c/o Lois Hill
874 Adams Avenue
Livermore, CA 94550

Livermore Paper Project
Congregation of Mormon Church
2nd Ward
950 Mocho
Livermore, CA 94550

Other (Continued)

Valley Ecology Center
401 South "K" Street
Livermore, CA 94550

Newspapers

The Livermore Independent
2219 A First Street
Livermore, CA 94550

Valley Times
6908 Village Parkway
Dublin, CA 94566

Oakland Tribune
Tribune Tower
Oakland, CA

The Daily Review
325 South "I"
Livermore, CA 94550

Tri-Valley Herald
Livermore Office
325 South "I"
Livermore, CA 94550

Pleasanton Times
P. O. Box 188
Pleasanton, CA 94566

San Francisco Chronicle
Livermore Office
P. O. Box 415
Livermore, CA 94550

San Francisco Examiner
P. O. Box 415
Livermore, CA 94550

The Montclarion
6208 La Salle Avenue
Oakland, CA

Berkeley Daily Gazette
2049 Allston Way
Berkeley, CA

Newspapers (Continued)

Alameda Times Star
1516 Oak Street
Alameda, CA 94501

Albany Times
1420 Solano Avenue
Albany, CA

Alameda County Observer
991 Williams Street
San Leandro, CA 94577

The Argus
37070 Fremont Boulevard
Fremont, CA

Portuguese Journal
3240 East 14th Street
Oakland, CA

Libraries

Business and Government Library
Montgomery Street
Hayward, CA (2 copies)

Alameda Public Library
9th and Santa Clara
Alameda, CA 94501

Berkeley Main Library
Shattuck Avenue and Kittridge
Berkeley, CA 94700

San Leandro Public Library
Community Library Center
300 Estudillo Avenue
San Leandro, CA 94577

Oakland Main Library
125 - 14th Street
Oakland, CA 94600

Union City Library
33942 Alvarado-Niles Road
Union City, CA 94587

Libraries (Continued)

San Lorenzo Library
395 Paseo Grande
San Lorenzo, CA 94580

Pleasanton Library
4333 Black Avenue
Pleasanton, CA 94566

Niles Library
150 "I" Street
Fremont, CA 94536

Newark Library
37101 Newark Boulevard
Newark, CA 94560

Irvington Park Library
41825 Blacow Road
Fremont, CA 94536

Fremont Library
39770 Paseo Parde Parkway
Fremont, CA 94536

Fairmont Library
15400 Foothill Boulevard
San Leandro, CA 94578

Dublin Library
6936 Village Parkway
Dublin, CA 94566

Castro Valley Library
20055 Redwood Road
Castro Valley, CA 94546

Livermore Library
1000 South Livermore Avenue
Livermore, CA 94550

Albany Branch Library
1260 Solano Avenue
Albany, CA 94706

Industry

Associated Homebuilders of the Greater East Bay
Hotel Claremont
Berkeley, CA 94705

East Bay Chapter of California Council of Engineers and Land Surveyors
c/o Robert Floyd
P. O. Box 287
Walnut Creek, CA 94596

Southern Alameda County Board of Realtors
21144 Mission Boulevard
Hayward, CA 94544

California Refuse Removal Council Northern District
c/o Lawrence A. Zunino, President
Solano County
Vallejo Garbage Service
710 Marin Street
Vallejo, CA 94590

Oakland Scavenger Company
2610 Peralta Street
Oakland, CA 94607

Pleasanton Garbage Service
P. O. Box 399
Pleasanton, CA 94566

DePaoli Equipment Company
c/o Ralph Properties
4001 Vasco Road
Livermore, CA 94550

Turk Island Company
Neptune Drive
San Leandro, CA

Mr. Myron Jones
c/o Pacific Gas & Electric Company
Gas Resources Division
245 Market Street
San Francisco, CA 94106

Industry (Continued)

Bay Area League of Industrial Associations
Eveleth Hayden, Exec. Vice-Chairman
3640 Grand Avenue
Oakland, CA 94610